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Dispersion of Pollutants Near Highways

Data Analysis and Model Evaluation

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The validity of various assumptions underlying mathematical modeling of pollutant dispersion near at-grade highways was examined and the simulation capability of various dispersion models determined. The data base generated during the Long Island Dispersion Experiment is utilized to study the micrometeorological characteristics adjacent to a highway and to evaluate four numerical and four Gaussian highway dispersion models.

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Data Analysis and Model Evaluation

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ABSTRACT

The primary objective of this investigation is to examine the validity of various assumptions underlying mathematical modeling of pollutant dispersion near at-grade highways, and to determine the simulation capability of various dispersion models. In this regard, the data base generated in the ROAD project (see Rao et al, 1978a) is utilized to study the micrometeorological characteristics adjacent to the highway and to evaluate four numerical and four Gaussian highway dispersion models.

Analysis of the particulate data reveal that although about 30% of the automobiles at the site had catalytic converters, there is no significant contribution of sulfur or sulfate due to the automobiles. The average ratio of sulfate to sulfur is 3.22, indicating that most of the sulfur (if not all) is in the form of sulfate. The highway traffic is found to be the dominant source for lead. Analysis of the turbulence measurements at the site indicate that the range of frequencies affected by the traffic appears to be 0.1 to 1.0 Hz, corresponding to eddy sizes of the order of a few meters. Even under quite stable atmospheric conditions, no organized convections due to vehicle exhaust heat can be distinguished in the spectral structure. The aerodynamic drag due to moving vehicles on the highway is manifested by a pronounced acceleration of wind in the lowest 8 meters, especially in the cases of wind flow nearly parallel to the highway. The impact of traffic-induced turbulence highway dispersion on the near-roadway dispersion of air pollutants is assessed.

Of the eight models evaluated, the best performance is given by the General Motors model for this set of data; it showed the highest explanation of variance (r^2), and had a slope close to unity for all cases, when unstable stability was used. As should be expected, all 8 models generally performed best for the perpendicular wind-road orientations. The comparison of parallel wind cases indicates that here the General Motors model was markedly better than the other models. For this simple line source, the numerical models and the Gaussian models performed about the same. Finally, the dispersion parameters used in the Gaussian models are evaluated. The dispersion parameter values observed in this experiment are close to those specified in the EPA-HIWAY model for the stability 2 category. It is suggested that the dispersion parameters may be specified in terms of wind fluctuation statistics rather than a power law relation for estimating dispersion near highways.

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SECTION 1

INTRODUCTION

In the preparation of implementation plans, indicating how air quality standards will be met and maintained, highway sources have received considerable attention since motor vehicles are important sources of carbon monoxide, hydrocarbons, and oxides of nitrogen. Environmental impact statements for such highways come under close and highly critical scrutiny by federal, state, and local air pollution control agencies, whose concurrence on the acceptability of air quality impacts is a prerequisite to approval of federal-aid highway funding. Mathematical modeling techniques are being widely used to predict the levels of pollutant concentrations adjacent to highways. However, the accuracy and applicability of various mathematical dispersion models are largely unknown due to lack of sufficient testing of the models with field data. Lack of confidence in the accuracy of modeling results, and lack of data acquisition standards and model validation, has been a major stumbling block in obtaining approvals. In order to evaluate the simulation capability of the models for at-grade roadways, a detailed data base consisting of carbon monoxide, sulfate, lead and total particulates, traffic counts, and meteorological variables were collected during the period October 1976 through May 1977 at a location on the Long Island Expressway (I-495). In addition, several tracer gas experiments were conducted as part of this field project. A complete account of the experimental set-up and data collection procedures is given in Rao et al (1978a).

The major objective of this investigation is to analyze the above data base to examine the validity of various assumptions underlying mathematical modeling of pollutant dispersion near at-grade highways and to determine the simulation capability of various mathematical dispersion models. Special attention is given to identification of the effects of local turbulence sources on the dispersion of pollutants. In particular, the effect of traffic on the turbulent structure is assessed, and the time and space scales of the eddies generated by the traffic are inferred. This report describes the data management and analysis techniques in section 2. Various dispersion models are tested against the data base in section 3. The results of this study are summarized in section 4. The data on carbon monoxide and meteorological conditions used in this analysis are given in Appendix I. The particulate data along with the pertinent information are presented in Appendix II.

SECTION 2

DATA MANAGEMENT AND ANALYSIS

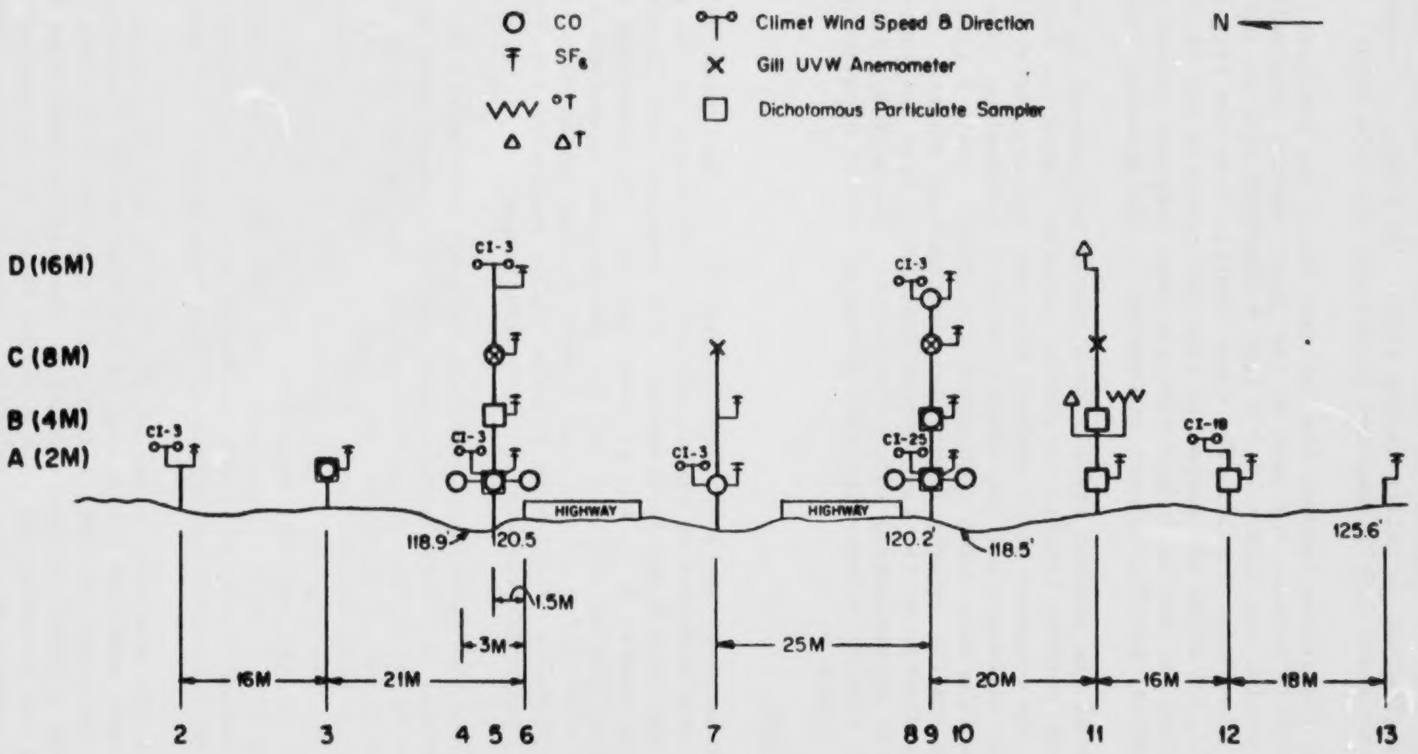
The aerometric and traffic data analyzed in the study were obtained adjacent to the Long Island Expressway near Huntington, New York. The location of various meteorological and air quality measuring sensors is shown in Fig. 1. The data collection procedures are briefly described here. The reader is referred to Rao et al (1978a) for a complete description of the instrumentation used and the data acquisition techniques followed.

TRAFFIC DATA

Each lane on the expressway had a pair of induction loops imbedded in the pavement. A separation distance of 3.5m between loops was used. These loops were connected to loop-detectors. Each sensor was polled via interface circuitry by the on-site minicomputer periodically for the presence of vehicles. The length and speed of each vehicle was computed from this information and classified into 5 length and 10 speed categories for each direction. A time-lapse photography system was used once a week as a further check on the traffic measurements made by the computer.

Of the 32 films taken during the study, 20 were judged to be satisfactory for analysis. The others suffered from unclear pictures, improper camera placements, or failure of the timing mechanism to work properly. Altogether, 450 ten-minute counts were derived from the 20 films. These were analyzed for vehicle count and mix for the time of day by direction. The 450 ten-minute counts are comprised of westbound data from 7:50 am to 4:40 pm and eastbound data from 9:10 am to 1:40 pm. This yielded 80 unique ten-minute intervals. A weighted average coefficient of variation for traffic volume was computed using the average of the ratios of standard deviation to mean, weighted by the number of observations in a given interval. However, in the calculation of the standard deviation for each interval, seven of these intervals were ignored since they had only a single observation. Thus, the film data analyzed had 73 usable intervals, composed of 443 observations, which yielded a weighted average coefficient of variation of 0.08.

The computer counts for total traffic by direction for the period between November 24, 1976 to December 22, 1976 were also analyzed. This data period was selected since the loop-detectors often malfunctioned afterwards. These data were segmented into weekday (Monday through Friday), Saturday and Sunday groupings and analyzed for composite vehicle count for ten-minute intervals. A review of these results showed existence of similar daily traffic patterns from Monday, 6 am to Friday, 6 pm. The weekday computer traffic had 3,856 ten-minute vehicle counts for the 288 intervals (i.e. 144 ten-minute periods for 24 hours times the two traffic flow directions). These data yielded a


CO
SF₆
°T
ΔT
Climet Wind Speed & Direction
Gill UVW Anemometer
Dichotomous Particulate Sampler
N
D (16M)
C (8M)
B (4M)
A (2M)
CI-3
CI-3
CI-3
CI-3
CI-3
CI-25
CI-18
HIGHWAY
HIGHWAY
118.9'
120.5
120.2'
118.5'
125.6'
1.5M
3M
25M
16M
21M
20M
16M
18M
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Not to scale

Figure 1 Schematic of meteorology and air quality sampling locations.

weighted average coefficient of variation of 0.12. If this data base was reduced to the same 73 segments as used in the film analysis, the weighted average coefficient of variation became 0.08. The number of observations for the computer data was 1,041, compared to 443 for the film data.

A linear regression between the two data bases was performed. Using the mean total traffic volumes for each of the joint weekday intervals, the regression equation was FILM = -7.5 + 1.01 * COMPUTER with an explained variance of 0.96 (See Figs. 2 & 3). The total traffic from the film for these periods was 36,501 while the composite from the computer was 36,761. From the above statistics, it can be judged that the mean computer counts are representative of the actual traffic volumes determined by photographic analysis.

Analysis of the weekend traffic data showed its pattern to be different enough from the weekday traffic to warrant separate composite data. It is assumed that the computer based weekend data are representative of the actual traffic on the highway since the weekday traffic surrounding them agreed with the composite film data taken throughout the study. Table 1 lists the composite hourly traffic volumes found from the computer counts. The average weekday daily traffic on the Long Island Expressway near the experimental site was found to be approximately 107,000 vehicles. The weekday, Saturday and Sunday hourly traffic volumes for each direction of the experimental site are presented in Figure 4.

PARTICULATE DATA

Eight dichotomous samplers, manufactured by the Environmental Research Corporation, were employed to sample ambient particulates in two size ranges, greater and less than 3.5μm in diameter. Six samplers were located at heights of 2m and 5m on towers 5, 9, and 11 (see Fig. 1). The remaining two were located at 2m height on towers 3 and 12. Particulate measurements were taken five days per week for a duration of 2 hours during the morning and evening peak traffic periods. Fluoropore filters (0.5μm pore size and 47mm in diameter) were used to sample particulates in both size ranges.

Filters for the dichotomous samplers were weighed before and after each run with a Mettler M-5 Microbalance under constant temperature and humidity conditions to determine the particulare mass. Further analysis of these filters for lead and sulfur were made using a Siemen's Model VRS wavelength dispersive x-ray fluorescence (xrf) spectrometer. A molybdenum target tube powered by a K-4 generator was employed throughout this study. Each particulate sample was analyzed for both lead and sulfur using lithium fluoride (200) and graphite crystals, respectively. The calibration standards for this phase of the analysis are described in Rao et al (1978a). Final data processing was made on a Hewlett-Packard Model 9130 programmable calculator.

Following the analysis of sulfur and lead by xrf techniques, the particulate filters were analyzed for anions of interest by ion chromatography. The samples were extracted in 6 milliliters of a solution of 0.0030M sodium bicarbonate and 0.0024M sodium carbonate. The samples were then loaded into a sample tray for introduction into a Dionex Model 10 ion chromatograph to determine the concentrations of chloride, fluoride, bromide, nitrate, and

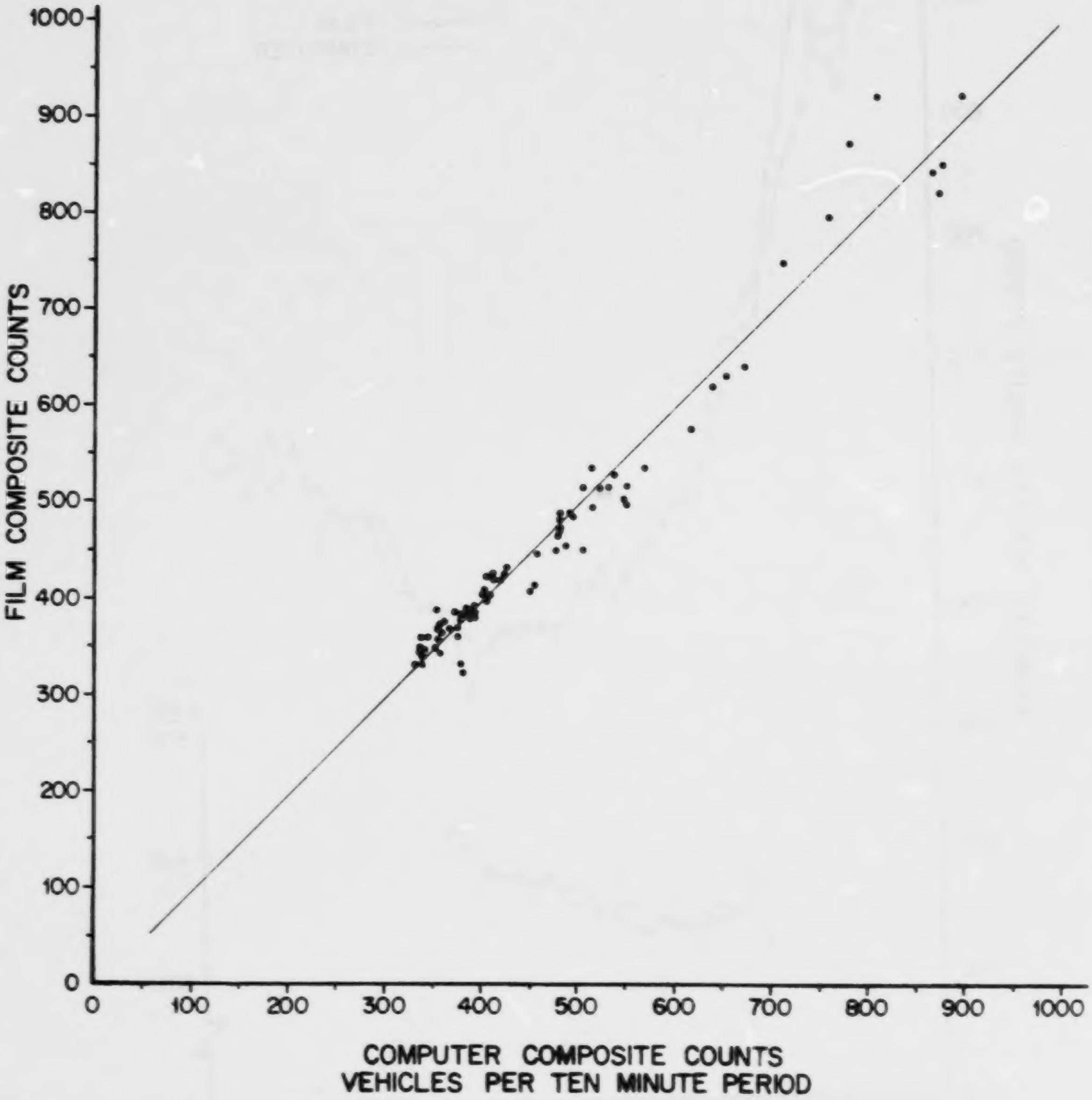


Figure 2 Scatter diagram showing the computer and film traffic data at the site.

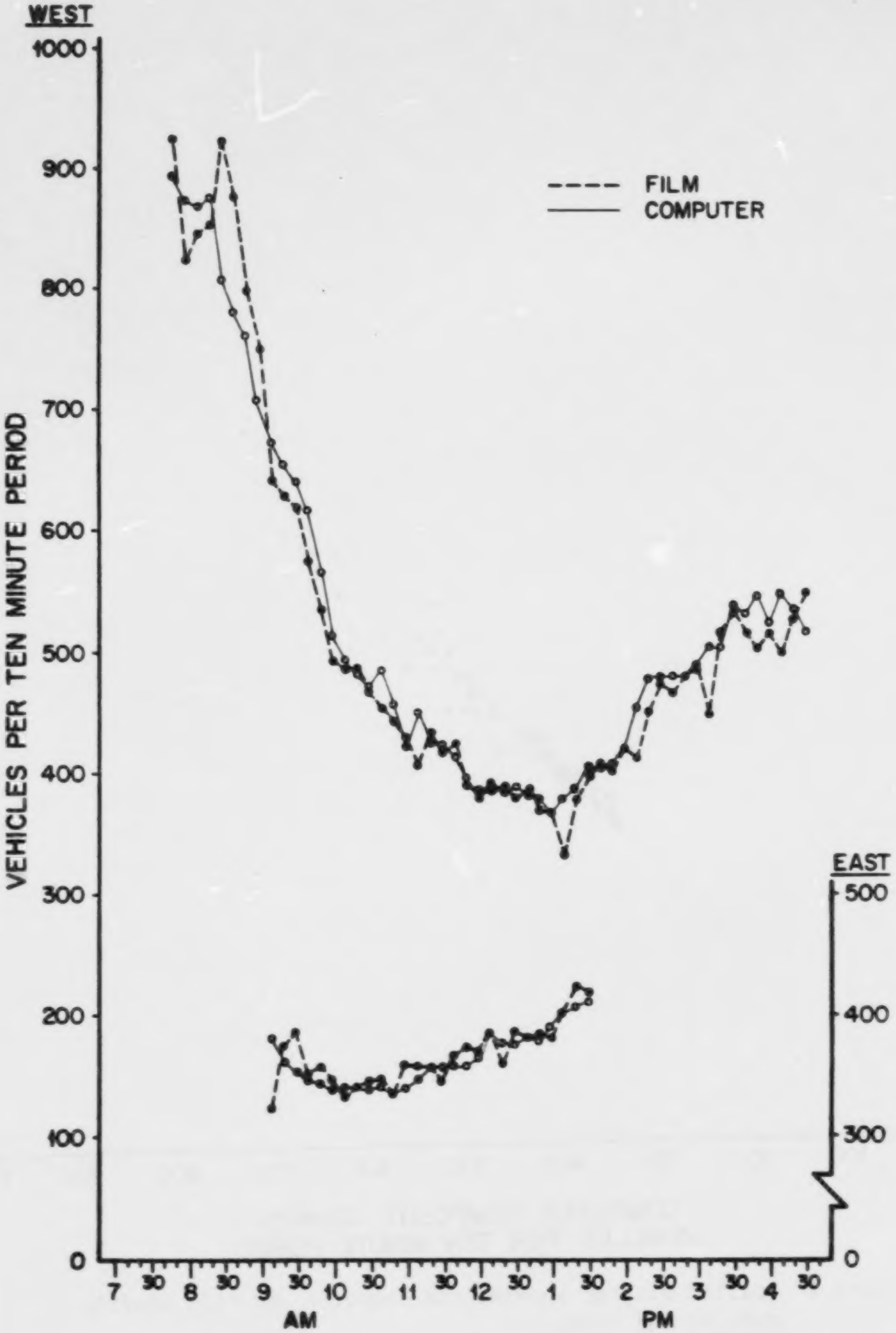


Figure 3. Comparison between computer traffic counts and film traffic counts for each direction.

Hour (starting time)	Weekdays (Monday 6 AM to Friday 6 PM)		Saturday		Sunday		Monday Morning (12 AM to 5 AM)	
	WEST	EAST	WEST	EAST	WEST	EAST	WEST	EAST
0	427	1262	757	1946	1049	1962	429	1104
1	238	698	582	1423	1057	1676	248	566
2	225	450	415	866	755	1202	228	337
3	300	303	335	628	393	714	298	241
4	731	271	458	465	293	399	721	224
5	2728	331	957	381	396	285	2728	300
6	5144	1183	2042	619	731	329		
7	5402	2464	2680	1139	874	576		
8	4959	2708	3053	1815	997	911		
9	3857	2189	2879	2042	1448	1147		
10	2905	2032	2743	2434	2147	1610		
11	2531	2114	2694	2916	2889	2119		

TABLE 1 COMPOSITE HOURLY TRAFFIC VOLUMES DERIVED FROM THE COMPUTER COUNTS

Hour (starting time)	Weekdays (Monday 6 AM to Friday 6 PM)		Saturday		Sunday		Friday Evening (6 PM to 11 PM)	
	WEST	EAST	WEST	EAST	WEST	EAST	WEST	EAST
12	2306	2263	2699	3063	2908	2553		
13	2350	2472	2716	3057	3016	2871		
14	2802	3115	2732	3145	2946	2903		
15	3117	4403	2553	3552	2633	2750		
16	3157	4866	2448	3405	2706	2863		
17	2711	4700	2215	3095	2617	2722		
18	2003	4296	2199	2892	2370	2371	2324	4382
19	1534	3286	2273	2524	2297	2380	2015	3712
20	1016	2621	1695	2149	2160	2255	1436	2921
21	961	2280	1236	1799	1816	1965	1083	2554
22	1114	2062	1275	1639	1502	1658	1097	2202
23	839	1643	1152	1705	1048	1359	876	2079

Table 1 (continued)

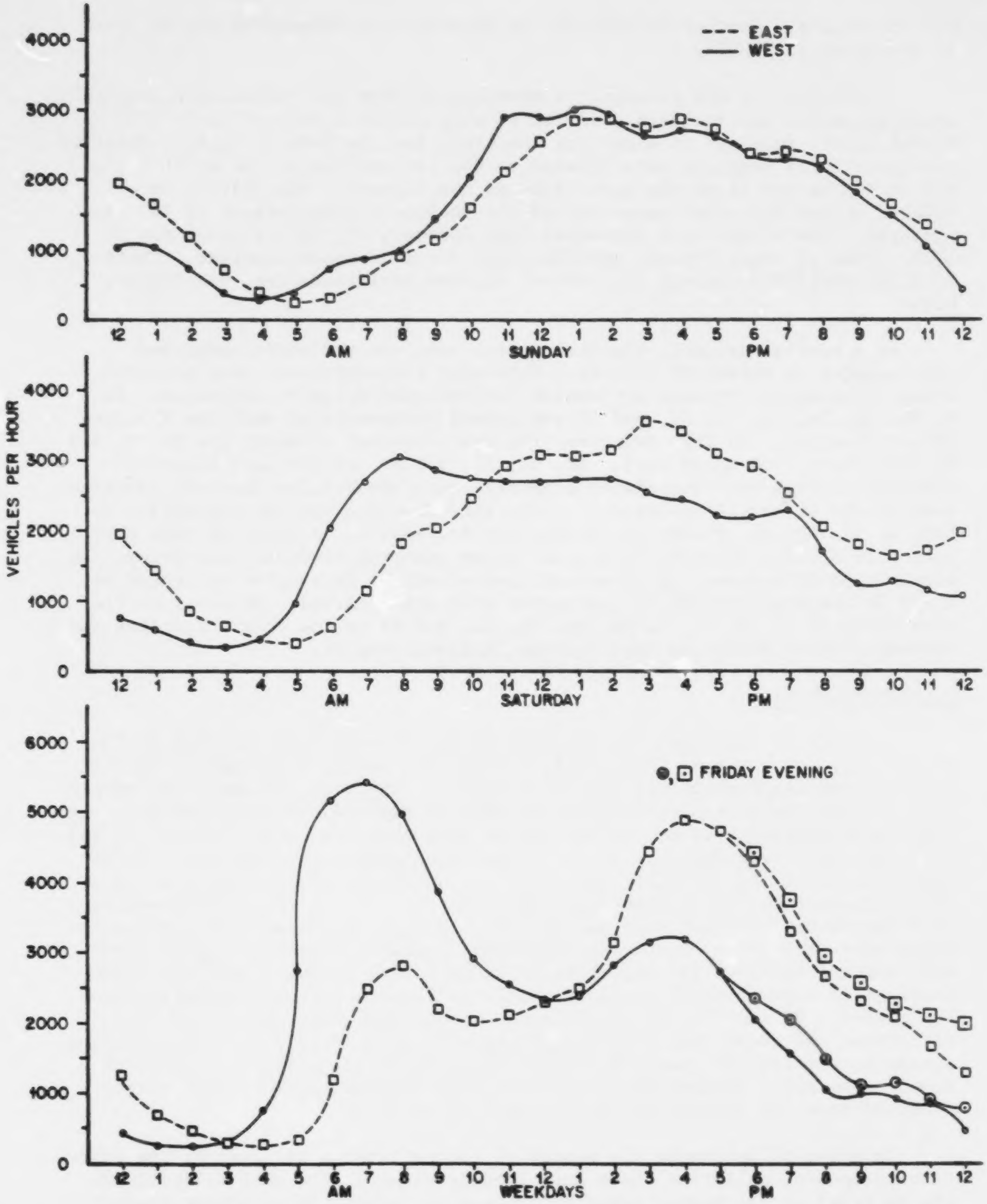


Figure 4 Hourly traffic volumes for the weekdays, Saturday and Sunday in each direction.

sulfate anions. Further details on the experimental procedures can be found in Keenan et al (1978).

In addition to the particulate measurement from the dichotomous samplers, total suspended particulates (TSP) were collected on a 24-hour basis with six hi-volume air samplers as a part of the study for the Federal Highway Administration. Three samplers were located at 9A, 11A and 13A on the south side, and at 1A, 3A and 5A on the north side of the highway. The filters were weighed before and after exposure and the 24-hour concentrations of TSP were computed. These data were collected from February 27, 1977 through May 27, 1977. Some of these filters were analyzed for lead concentrations. These data are available through the Federal Highway Administration, Washington, D.C.

As a special project, the dichotomous samplers collected suspended particulates on nuclepore filters. Elemental concentrations were measured using instrumental neutron activation analysis and X-ray Fluorescence. Na, K, Mn, Cu, Zn, Ga, Br, Sr, and Sb are primarily associated with the $< 3.5\mu m$ (fine) fraction. In this fraction, the most abundant elements are Br, K, and Zn (all above 1200 ng/m^3 air). Si, Ca, Ti, and Fe are the only elements measured in this work associated primarily with the $> 3.5\mu m$ (coarse) fraction. Some of the elemental abundances in the fine fraction are (in percent): Na, 100; K, 95-100; Mn, 89-98; Cu, 83-95; and Br, 89-100. A study of size distribution in $< 3.5\mu m$ fraction is planned using scanning electron microscopy. No significant differences in elemental concentrations in samples collected at 2 and 5m above the ground on the upwind side are observed. However, on the downwind side Si, K, Ti, V, Mn, Fe, Br, Rb, and Sr in the coarse fraction show somewhat higher concentrations for the 2m level samples.

Observed Features

In order to establish the reliability of the data base for each of the pollutants, the analyzed fine particle data were averaged for each sampling position and the results are given in Table 2. Position 12A has fewer samples than the rest because this sampler was used to replace the other samplers when they malfunctioned. It is interesting to note that the concentrations of sulfur, and, to a fair degree, sulfate remain constant at all receptors in the sampling plane. On the other hand, the concentration of lead shows a significant enhancement at the two roadside receptors (5A and 9A), and decreases with increasing distance from the highway. Some of the upwind lead concentrations were reported as less than a threshold value (generally $0.6\mu gm^{-3}$) and were assumed equal to the threshold value for all subsequent analyses. The increase in concentration of particulates at the two farthest receptors from the highway, 3A and 12A, is probably due to fugitive dust, introduced by a dirt farm road about 10m north of the receptor 3A and the dirt road providing access to the trailer near 12A. The average ratio of sulfate to sulfur is found to be 3.22, indicating that within experimental error all the sulfur detected from the filters was in the form of sulfate.

In order to determine the source of the pollutants observed at the roadside receptors, pollution roses have been developed. The wind direction at the 8m level of the median tower 7 was used to relate the pollutant concentra-

Sampler			Pollutant (μgm^{-3})				
Sampler Position	Height (m)	Distance from the Median Center (m)	Fine Particulates mean/sd # of samples	Sulfate mean/sd # of samples	Sulfur mean/sd # of samples	Lead mean/sd # of samples	Ratio of SO_4/S
3A	2	44.5	38.2/28.5 132	6.7/5.3 128	2.1/1.4 136	1.7/1.4 137	3.19
5B	5	25.0	37.8/22.2 123	6.9/5.6 125	2.0/1.4 128	2.0/1.7 129	3.45
5A	2	25.0	41.6/23.8 135	7.3/5.6 132	2.2/1.5 140	3.2/2.5 141	3.32
9A	2	25.0	42.7/23.0 140	7.1/4.9 130	2.2/1.5 142	3.1/1.9 142	3.23
9B	5	25.0	34.3/20.7 142	6.7/5.4 136	2.1/1.4 145	1.7/1.1 145	3.29
11A	2	44.5	34.8/17.6 141	6.7/5.4 137	2.1/1.5 144	1.8/1.0 115	3.19
11B	2	44.5	35.8/21.2 113	5.8/3.8 105	2.1/1.5 144	1.5/0.9 119	2.76
12A	2	61.0	38.3/21.8 95	7.3/5.8 98	2.2/1.6 101	1.5/0.9 101	3.32

Average ratio of SO_4/S = 3.22 ± 0.20

TABLE 2 OBSERVED PARTICULATE POLLUTANTS DATA AT VARIOUS RECEPTOR LOCATIONS ADJACENT TO THE HIGHWAY. INCLUDED IN THE TABLES ARE THE MEAN, STANDARD DEVIATIONS (SD), AND TOTAL NUMBER OF SAMPLES AT EACH RECEPTOR LOCATION

tions to wind direction. The wind components parallel and perpendicular to the highway were computed and averaged over each period the samples were run. From this a resultant wind direction was obtained for comparison with resulting pollutant concentrations. Figs. 5a and 5b show the directional contribution of sulfur and lead to the observed concentrations. The variation in magnitude and directional dependence of sulfur concentrations between receptors is quite small as seen in Fig. 5a. These concentrations demonstrate no apparent relationship to the wind-road orientation angle. The observed concentrations at all receptor locations seem to indicate the back ground levels. The maximum concentrations are most likely to occur whenever the wind direction is northeast or southwest. It is possible that large point sources situated along those directions or regional transport patterns could contribute significantly to the concentrations observed at these receptors. Contrary to the sulfur roses, lead, indicated in Fig. 5b, shows a pronounced decrease in concentration as the distance from the highway increases. Also, the lead roses show a strong dependence between wind direction and receptor-roadway location, with highest concentrations coming from the highway.

The observed concentrations of fine suspended particulates (FSP), sulfur, and lead at the two receptors closest to the highway, 5A and 9A, and the difference between these receptors by wind sectors are plotted in Figs. 6a,b,& c as a function of wind direction. Here, a wind direction of 180° (southerly) and 0° or 360° (northerly) indicate that the wind flow is perpendicular to the highway. 90° (easterly) and 270° (westerly) represent wind flow parallel to the highway. From these diagrams, it is evident that while the highway is an important source for particulates (contributing up to $20 \mu gm^{-3}$), and the dominant source for lead (contributing up to $4 \mu gm^{-3}$), the sulfur concentration due to the highway is at the very most $0.2 \mu gm^{-3}$.

As a maximum, 30% of the cars on the expressway were equipped with catalytic converters and, therefore, used unleaded gasoline. Assuming that these cars had a sulfate emission rate of approximately 0.003gm/mile/vehicle, while the rest of the vehicles had a lead emission rate of approximately 0.06gm/mile/vehicle, the lead emission rate on the roadway would be on the order of 50 times greater than the sulfate emission rate. This would account for the negligible amount of sulfate and significant lead concentrations observed near the expressway.

CARBON MONOXIDE DATA

The locations of CO measurements are indicated in Fig. 1. Sampling was done using non-dispersive infrared (NDIR) carbon monoxide analyzers, manufactured by the Beckman Corporation. Samples were drawn from each specific location through teflon tubing into mixing chambers at a fixed sampling rate. The chamber's volume was designed to dampen rapid variations in the concentration within the sampling interval without masking any long-period changes. After passage through the averaging chamber, the sample was pumped into the monitor. The electronic output signal was then transmitted to the data acquisition system. All NDIR's were calibrated and zeroed automatically at least 3-times a day.

For tower 9, a profile system was designed so that a single NDIR could

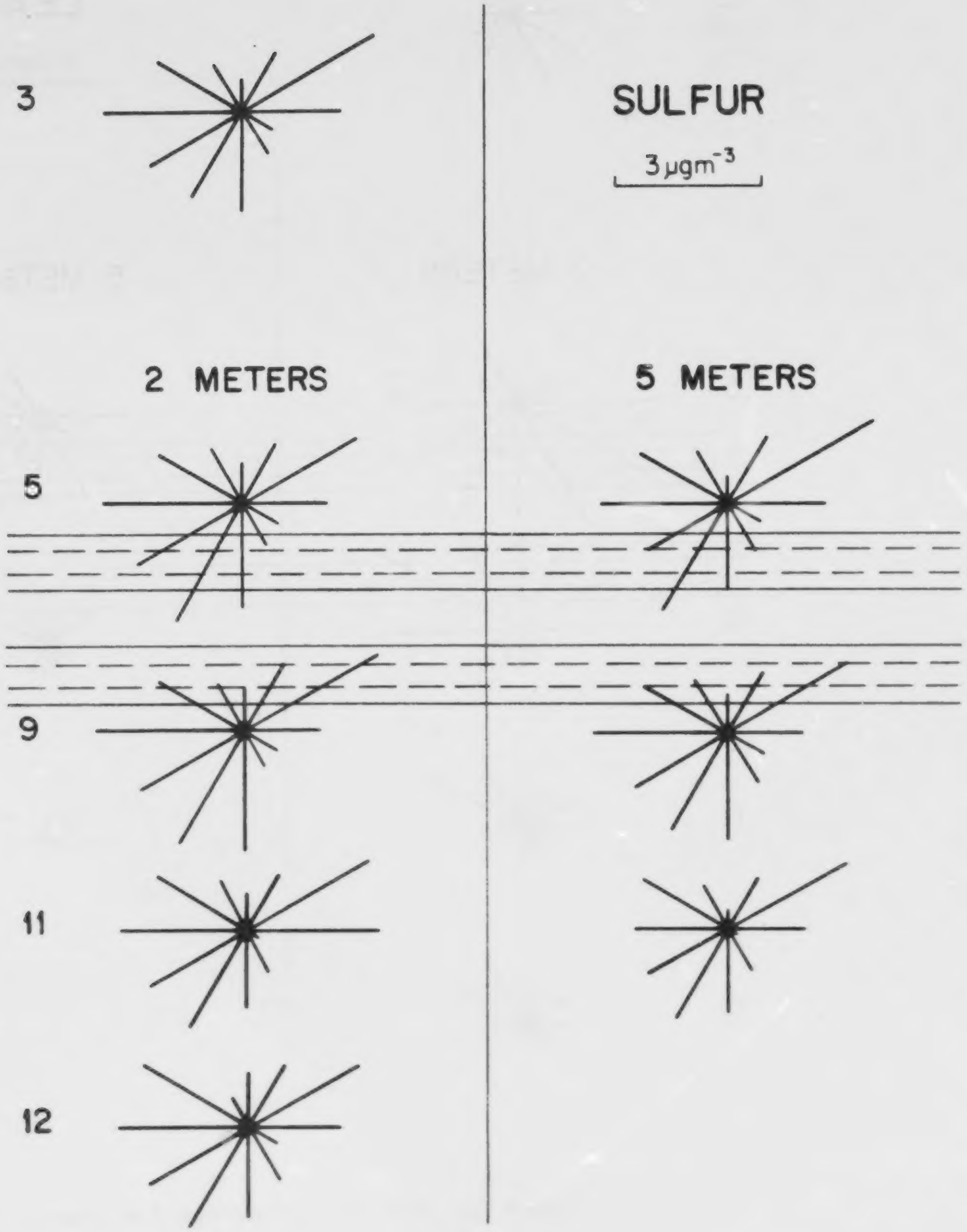


Figure 5a Pollution roses for sulfur at 2m height (left) and 5m height (right) at various receptor locations adjacent to the highway.

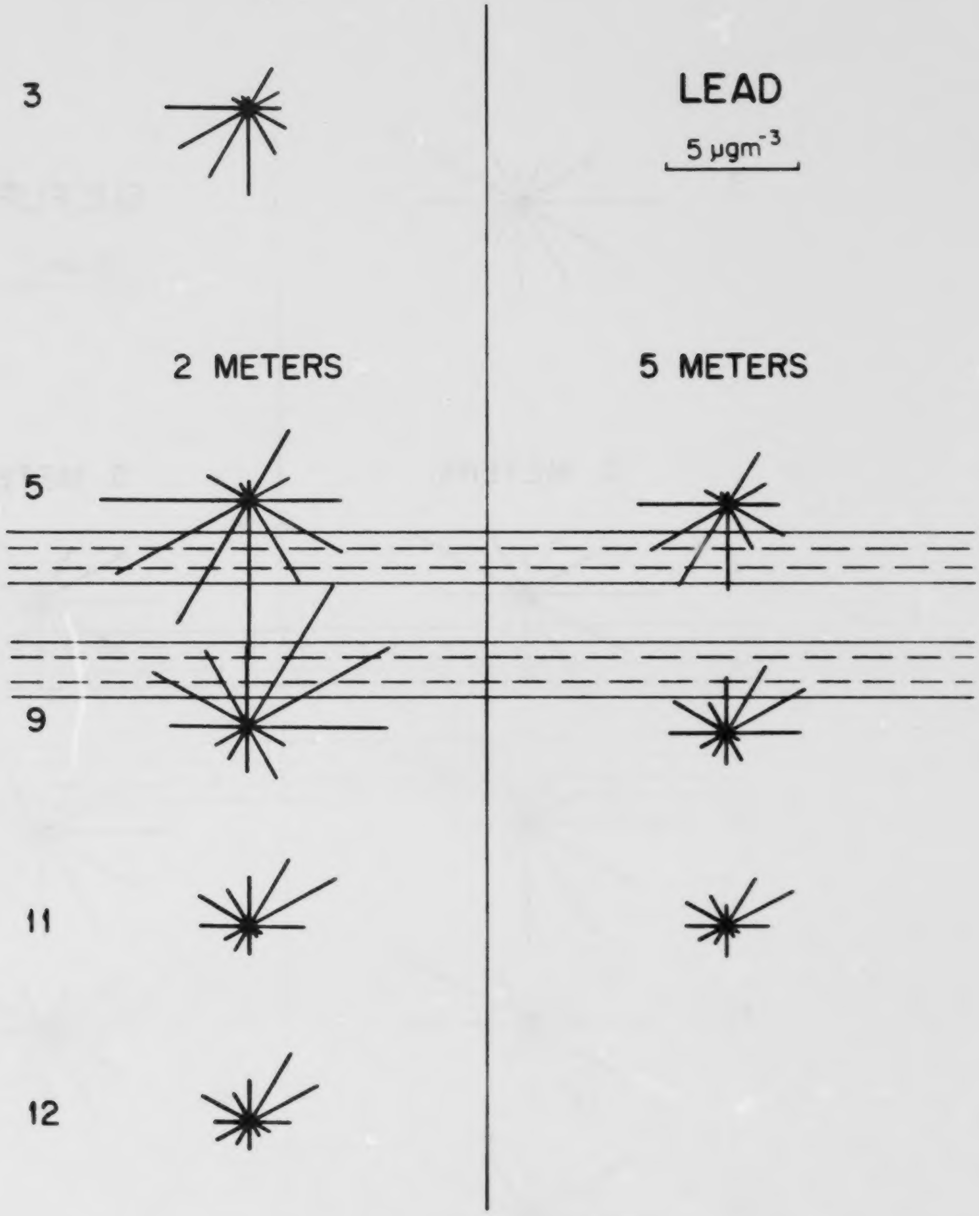


Figure 5b Same as (a) except for lead.

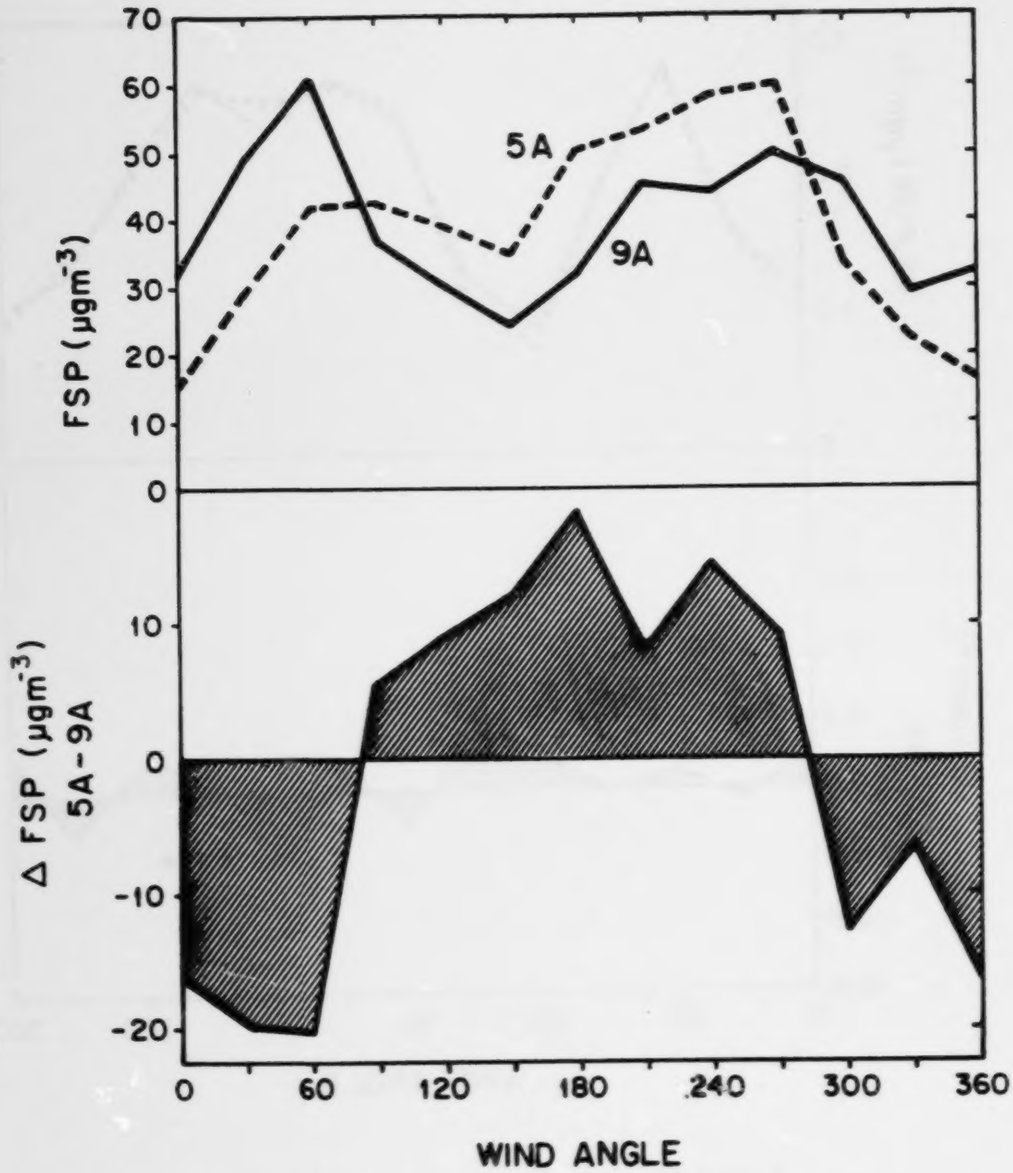


Figure 6a Composite concentrations and the difference in concentrations between the two nearest receptors to the highway of fine suspended particulates (FSP) as a function of wind direction.

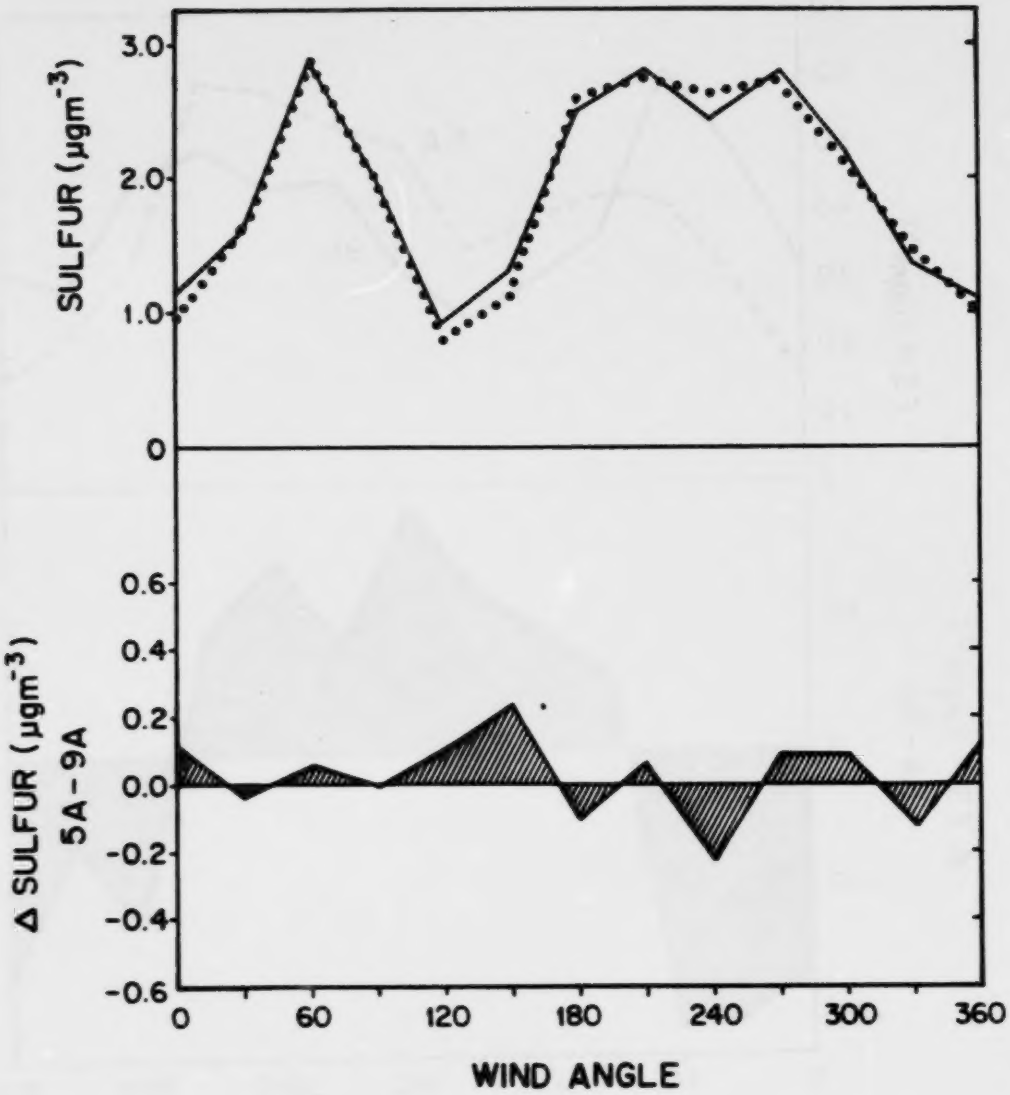


Figure 6b Same as (a) except for sulfur.

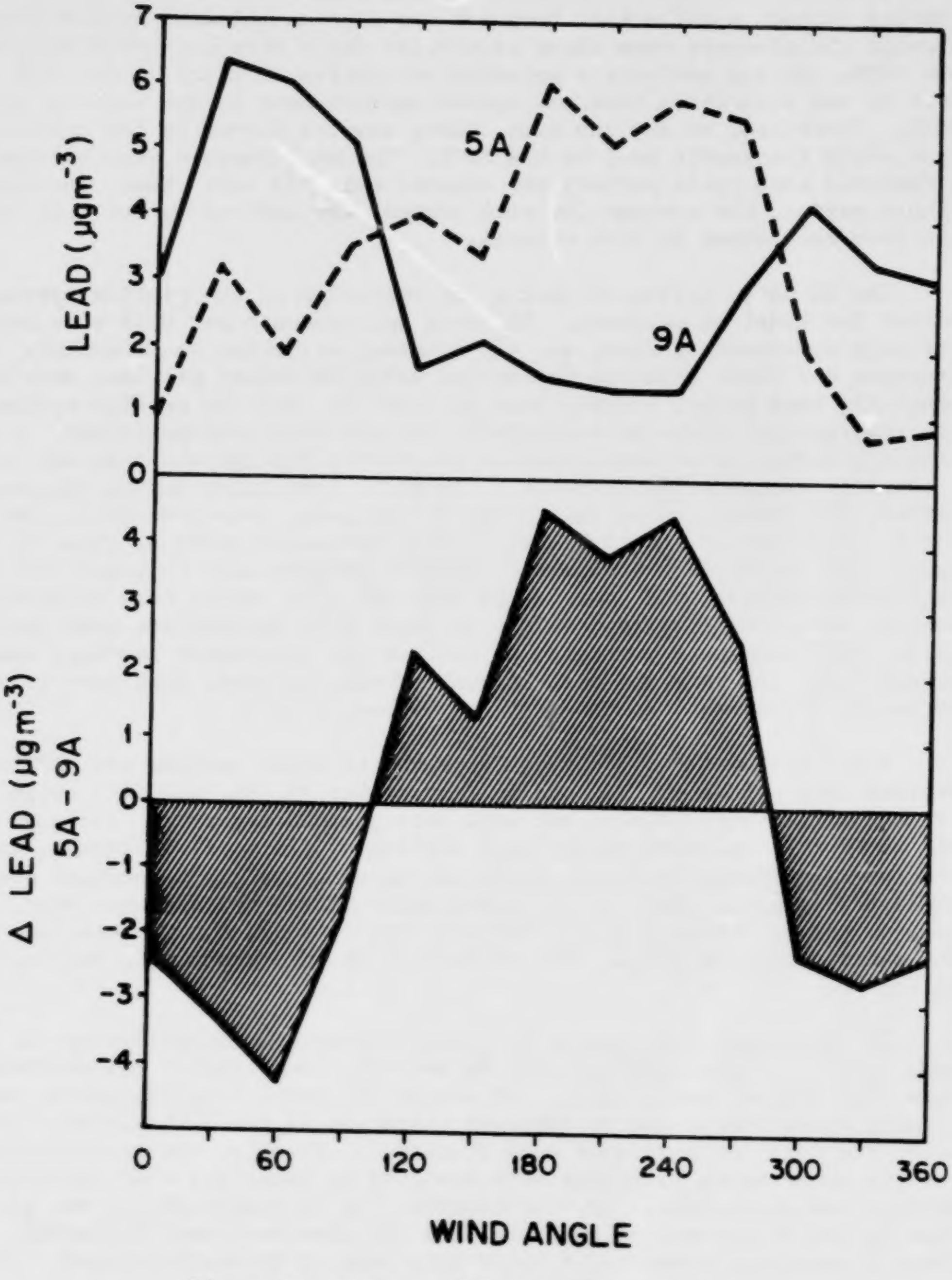


Figure 6c Same as (a) except for lead.

measure the concentrations at four points in a vertical line during a five-minute sampling cycle. Flow for these four averaging chambers was produced by either of two pumps, separated by three-way solenoids controlled by the computer. Matched flow meters were used throughout the system to assure the same constant flow for each chamber at all times. The main pump drew the samples through a collection tank and was used to maintain uniform flows through the chambers when those particular lines were not being analyzed by the NDIR. During analysis a solenoid was activated which closed that chamber's port to the collection tank and opened another port to the sampling pump and NDIR. Therefore, at any one time, three samples flowed to the collection tank while the fourth went to the NDIR. The minicomputer switched through 4 channels each cycle period; one channel every 75 sec. Thus, for each ten-minute period, the average for each channel was made using two readings, offset from each other by five minutes.

The CO data, collected during the operation of the profile system, was edited for modeling purposes. The four measurements per NDIR were averaged for each ten-minute period, and the standard deviation was computed. Hourly averages and their standard deviations using 24 values per hour were determined for each probe, except those on tower 9. For the profile system, only six readings per probe were available for the hourly computations. A large standard deviation in comparison to the hourly average would be due to either a sampling system malfunction or a change in conditions during the sampling period, for example, wind shift, traffic back-up, zero-span cycle, and so forth. A review of the ten-minute values indicated which of these to be the case. The hourly data management computer program also indicated how many ten-minute periods were used, since zero and span values were excluded. The average value was discarded unless at least four consecutive time periods were used. The ten-minute averages, as well as the individual reading, were used to determine the zero and span values. These, in turn, were used to make any necessary adjustments to the averaged values.

Since systematic differences appeared to exist between the NDIR's, it was decided that probes 4A, 5A, and 6A (and probes 8A, 9A, and 10A) could not be treated as separate points, but were best grouped together. Although the before and after zero and span values were available, the small difference in concentration among these locations could not be consistently determined even with these adjustments. Each set of three near-roadway measurements were, therefore, used to better define a single representative shoulder concentration. Thus, the eleven sampling points were reduced to seven, namely, 3A, 5A, 7A, 9A, 9B, 9C and 9D.

If the ground level probe 9A needed correction either due to the zero-span drift, or inconsistency with 8A and 10A, the vertical concentrations were also changed accordingly. If any of the seven sampling points had a missing measurement, due to improper operation of the NDIR during a given hour, the data for that hour were discarded. Finally, the hourly averages for the above seven locations were reviewed to ascertain that the cross-plane profile was consistent. If, for example, the 3A concentration was greater than 5A and 9A concentrations, the data for that hour were discarded. With these screening procedures, a valid data base of CO was developed. These data were used to evaluate the HIWAY model.

METEOROLOGICAL DATA

Since dispersion parameters derived from meteorological data are critical in determining pollutant concentrations within 100m of the highway, multiple measurements of meteorology were made. Four Gill three-component anemometers were installed at a height of 8m on towers 5, 7, 9, and 11. Seven Climet sensors were located at various positions as shown in Fig. 1. Temperature and temperature difference measuring systems, manufactured by Meteorology Research, Inc., were located on tower 11. In addition, solar radiation, relative humidity and precipitation were also measured.

Kinematic Analysis of Wind Structure

Most of the mathematical dispersion models give importance to the initial mixing, induced by the moving traffic on the roadway, in determining dispersion of pollutants. It is important to understand the induced mean motions as well as the turbulent fluxes of momentum and heat on the roadway to arrive at a meaningful parameterization of the traffic-generated turbulence. In instances of low ambient winds, traffic flow may result in mean vertical motion fields near the roadway; whereas at high wind speeds, the roadway could act as an abrupt change in surface roughness which may also result in induced vertical motions.

The wind speed and direction, measured at eight locations adjacent to the roadway, were averaged for the duration of each tracer run and the cross-road component of wind was computed. Since the roadway is a straight segment at the sampling location and the terrain is fairly homogeneous, the induced vertical motions can be computed from the derivative of the cross-road component assuming that derivatives of the parallel-road components are negligible. To compute vertical motion fields in a vertical plane perpendicular to the highway, it is necessary to objectively interpolate the measured values to a grid superimposed onto the plane. A grid size of 31 x 25 is chosen along the X - Z plane with x = 1.67m and z = 0.67m. A modified version of the Guardaddo and Sommers (1977) objective first-guess analysis algorithm is used to compute an initial field. This field is then fitted to the grid using the bi-cubic spline analysis described by Sommers (1977). This modified approach takes each measured point and constructs an axis in the x and z directions, computing first-guess values at each intersection with a fixed grid line. These first-guess values are computed using an elliptical weighting function skewed heavily in the x (horizontal) direction so as to maintain horizontal continuity of winds. Weighting W_{ij} at a particular grid intersection, i, for a known point j, at a distance $\sqrt{x_{ij}^2 + z_{ij}^2}$ is computed as

$$W_{ij} = \frac{r_{ij}^2}{\sum_{j=1}^{n} r_{ij}^2}$$

$$\text{where } r_{ij}^2 = \left(\frac{x_{ij}}{a}\right)^2 + z_{ij}^2$$

with the elliptical constant a arbitrarily set to 25. Once values had been estimated for an axis (x or z) at each grid intersection, the estimates are corrected to agree more accurately with the observed value(s) on that axis using a Legendre polynomial. This procedure is continued until a row and column have been generated for each known data point. Each fixed grid row is then splined using the first-guess values to obtain estimates at each fixed grid point. This process is then repeated for each column. Given two estimates (by row and by column) at each grid point, the values are averaged to arrive at the estimate of the scalar field.

The above technique lends itself to analysis of horizontal divergence on the plane since the spline operation also yields estimates of the first and second derivatives at each fixed grid point. The cross-road derivatives are available directly from the spline of the rows. The vertical motion field can then be computed by assuming the atmosphere within the grid to be incompressible. Thus, the vertical motion as a function of height, w(z), can be computed from the equation

$$w(z) = w(z - \Delta z) - \left\langle U_x \right\rangle \Delta z$$

where the subscript denotes the derivative in x and the notation $\left\langle U_x \right\rangle$ is the average of U_x over the layer $(z - \Delta z)$ to z.

Kinematic vertical motion fields are then generated for each run using the computed cross-road component at the 2m, 8m and 16m levels of towers 5 and 9 and the 2m and 8m levels of tower 7 in the median. The wind speed at the surface was set to zero. Figs. 7a and 7b shows two perpendicular runs, one with weak basic flow from north and the other with stronger flow from north. In both cases, vertical motions exist but the signs are reversed. Similar results are found for oblique winds, as shown in Figs. 7c and 7d. For parallel wind cases, however, the traffic-induced winds typically forced convergence into the roadway at low levels which is compensated by upward vertical motions above the roadway (see Figs. 7e and 7f).

TRACER GAS DATA

The tracer selected in this experiment was 99.9% pure instrument grade sulfur hexafluoride (SF_6) gas. The gas was contained in T-size cylinders with typical single stage regulators and gauges for tank and release pressure. This was modified by an additional valve and pressure gauge with a flow meter, calibrated for operation at 75 psig, so as to establish and monitor the SF_6 release rate.

Simulation of a line source was achieved by releasing gas at a constant rate near the tail pipes of six station wagons. They were driven in the middle lane at 88 km/hr in both directions. The end points of release are 845m east and 315m west of the sampling plane. The test-track for the tracer gas vehicles is shown in Fig. 8. All six vehicles were spaced at roughly equal intervals and made at least 8 laps around the circuit. Sampling of tracer gas was done for an hour's duration at several locations (see Fig. 1) across the plane by means of small capacity pumps connected to five-layer mylar bags via acrylic tubes. Samples were analyzed immediately after the experiment with an electron capture gas chromatograph.

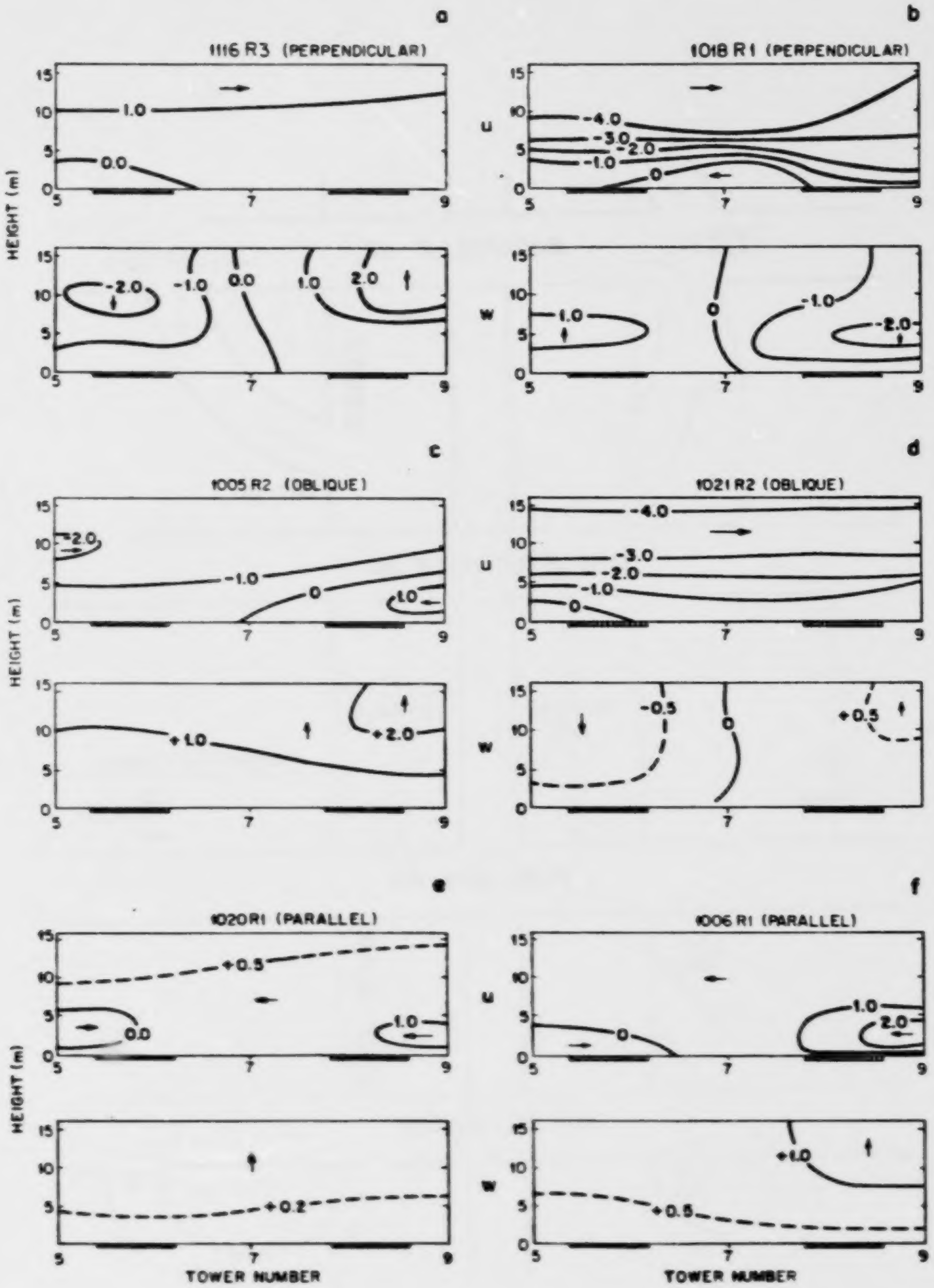


Figure 7 Horizontal (in m/sec) and vertical wind fields (in cm/sec) over the roadway for selected cases of perpendicular, oblique and parallel wind-road orientation .

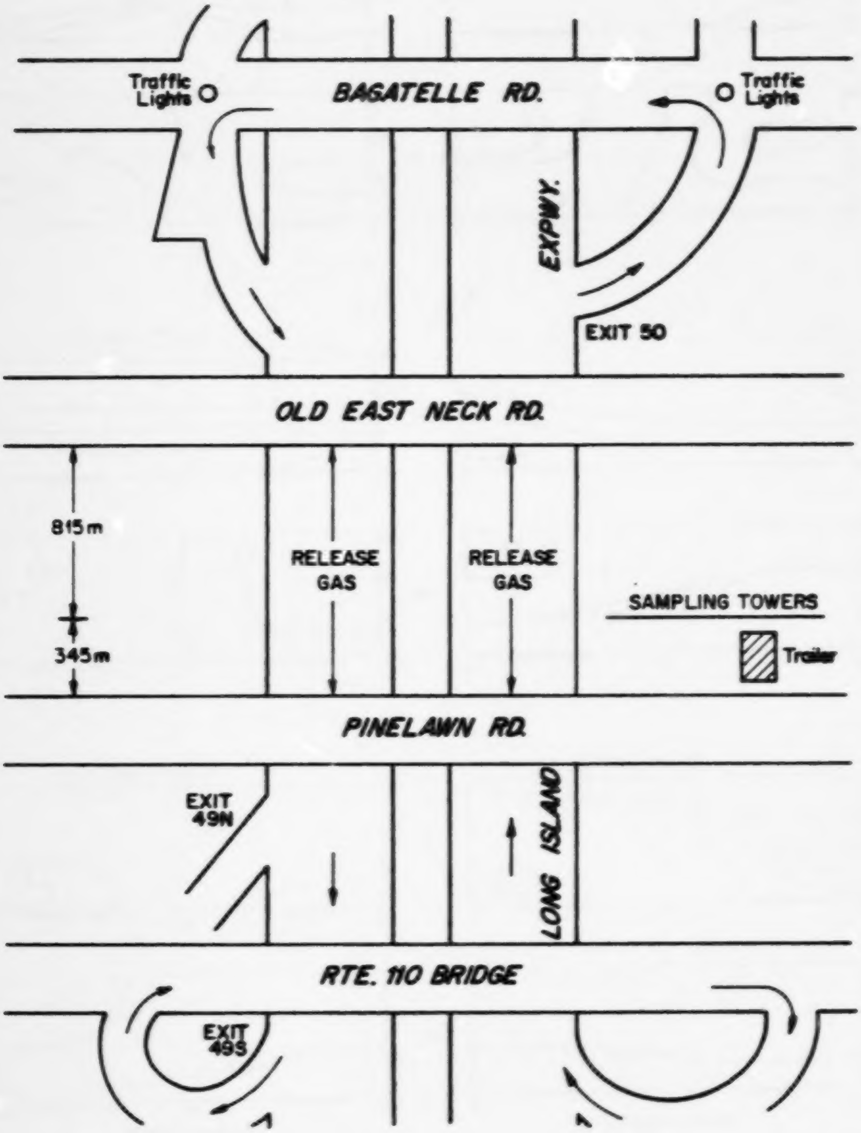

Traffic Lights
BAGATELLE RD.
Traffic Lights
EXPWY.
EXIT 50
OLD EAST NECK RD.
815m
RELEASE GAS
RELEASE GAS
SAMPLING TOWERS
345m
Trailer
PINELAWN RD.
EXIT 49N
LONG ISLAND
RTE. 110 BRIDGE
EXIT 49S

Figure 8 Circuit followed by tracer-release vehicles indicating location of the sampling plane and length of gas release.

A total of 23 tracer runs were made over three one-week periods. The runs reflect a wide range of wind speeds and directions. The meteorological conditions along with the total emissions for the runs are summarized in Table 3. From the routine cloud cover and wind speed measurements taken at the Islip airport (about 25km from the site), Pasquill-Turner stabilities were determined for the periods of interest. The local stabilities were obtained from the temperature gradients and wind speed measurements at the site. The observed tracer gas concentrations at various receptor locations in each of the tracer runs are presented in Table 4.

Observed Features

The observed SF_6 concentrations, normalized by the concentration at the 2m height of the nearest roadside receptor (5A or 9A), for perpendicular ($60^\circ \leq \theta \leq 90^\circ$), and parallel ($0 \leq \theta \leq 30^\circ$) conditions are presented in Fig. 9 as a function of downwind distance from the highway. The angle θ is the wind-road orientation angle with 0° being parallel to the highway. Also, the vertical profile of the normalized concentrations at the downwind tower (5 or 9) is included in the diagram. Two important features are apparent in Fig. 9:

(a) Under parallel wind-road orientations, the concentration reduced to about 45% of the maximum (averaged over all cases) at about 42m from the median, whereas it reduces only to around 65% of maximum for perpendicular wind-road orientations. At 80m distance, average reduction in concentration is approximately 77% of the maximum for parallel wind conditions, while it is about 60% for the perpendicular cases.

(b) The concentration decreases more rapidly with height in the perpendicular wind situations than in parallel wind conditions.

The above features are to be expected since under parallel wind conditions, there will be a buildup of pollutant levels in close proximity to the highway as cross-highway advection would be smaller. The isolines of concentration will be "stretched" in the vertical direction because vertical diffusion due to atmospheric eddy motion and vehicle-induced turbulence will become the important mechanisms for ventilation. Under perpendicular wind-road orientations, the transport term (cross-highway advection) becomes dominant resulting in a slower decrease of concentration with downwind distance.

The tracer gas concentrations, normalized by the line-source release rate, Q, and mean wind speed, U, for the cases of perpendicular and parallel wind-road orientations are presented in Figs. 10a through 10d. Although there is much variation in the magnitude of downwind concentrations in Figs. 10a and 10c, the general trend of the concentration profile is similar. The vertical profile of normalized concentrations for the perpendicular wind cases (Figs. 10b and 10d) indicate that at 8m height the concentrations have little variation from run to run. However, for parallel wind cases, there is still a large variation in the concentrations at that height. In both cases the values at 16m height show little variation.

Two other interesting features are evident from Figs. 10a and 10c; first, for the perpendicular case in contrast to the parallel case, the spread in magnitude at a given receptor is considerably less. Second, the ratio of the

TABLE 3 METEOROLOGICAL AND EMISSION SUMMARY FOR THE SF$_6$ EXPERIMENTS. THE STABILITY INDICATED FOR PASQUILL-TURNER WAS OBTAINED FROM ISLIP AIRPORT OBSERVATION. THE LOCAL STABILITY ESTIMATES WERE MADE USING THE TEMPERATURE GRADIENTS AND THE WIND SPEEDS MEASURED AT THE SITE. THE RUNS ARE CLASSIFIED AS PARALLEL (+ 30° FROM THE HIGHWAY AXIS), OBLIQUE (30 TO 60° FROM THE HIGHWAY AXIS), AND PERPENDICULAR (60° TO 90° FROM THE HIGHWAY AXIS, AND REPRESENTED BY THE SYMBOLS =, / AND ⊥ RESPECTIVELY

		SF$_6$ Emissions (gm)				Cross-Wind	Stability	
Run #	Mode	West	East	*Wind Speed (m/s)	**Wind Direction	Speed u cos θ (m/s)	Pasquill-Turner	Local
1005R1	=	2004	1809	3.6	65	1.52	D	B-C
1005R2	/	862	865	3.1	58	1.64	D	A-B
1006R1	=	935	865	2.1	99	-0.33	D	A-B
1006R2	⊥	789	712	1.8	178	-1.8	D	D
1007R1	=	840	743	3.6	261	-0.56	D	A-B
1007R2	/	886	816	2.3	232	-1.42	D	B
1008R1	⊥	941	872	2.5	190	-2.46	D	B
1018R1	⊥	804	746	4.6	334	4.13	D	B-C
1019R1	/	892	812	1.3	131	-0.85	B	A-B
1019R2	⊥	897	830	1.9	180	-1.9	D	B
1019R3	⊥	770	917	1.8	188	-1.78	C	B-C
1020R1	=	856	804	1.0	98	-0.14	C	B
1021R1	/	805	770	7.5	302	3.97	D	D
1021R2	/	1105	1108	6.0	302	3.18	D	C
1022R1	=	1061	1018	6.1	286	1.68	D	C
1115R1	/	827	776	2.0	240	-1.00	D	B-C
1116R1	⊥	906	834	5.0	15	4.83	D	B
1116R2	⊥	897	838	5.0	330	4.33	D	B
1116R3	⊥	910	820	0.9	1	0.9	G	G+
1117R1	/	890	849	3.4	240	-1.7	D	D
1118R1	/	900	825	6.5	319	4.91	D	D
1118R2	/	883	821	6.8	324	5.50	D	D
1119R1	=	903	830	5.4	293	2.11	D	C

* Wind speed from the 8 m height level of the median tower

** Wind direction measured relative north (perpendicular to highway)

TABLE 4 OBSERVED TRACER GAS CONCENTRATIONS AT VARIOUS RECEPTOR LOCATIONS

ROAD PROJECT SF6 SUMMARY

CONC IN PPB

RUN #	1A	2A	3A	5D	5C	5B	5A	7B	7A	9A	9B	9C	9D	11A	12A	13A
1005H1	0.9	1.2	1.1	0.7	0.8	1.2	1.6			10.4	7.1	2.9	1.7	5.1	3.7	2.6
1005H2	0.04		0.03	0.02	0.08		0.6			5.7	5.0	2.6	0.7	3.4	3.0	2.2
1006H1			2.2		2.9	4.8	6.3		5.0	7.5	4.8	2.5	1.2		0.8	0.5
1006H2	2.4	3.0	4.4	0.2	1.2	3.8	6.0		3.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1007H1	1.7	2.5	3.6	0.8	2.5	5.3	7.0		4.9	1.6	1.3	0.6		1.0	0.9	0.2
1007H2	2.3	3.9	4.2	0.7	2.8	6.0	7.5		4.0	1.5	0.6	0.3		0.9	1.0	1.3
1008H1	2.2	2.7	3.3	0.1	1.1	3.8	6.3		3.6	0.2	0.1	0.4	0.2	0.2	0.0	0.0
1018H1	0.0	0.0	0.0	0.0	0.0		0.0	1.0	2.1	3.8	1.5	0.3	0.1	2.4	1.7	2.0
1019H1	8.5	6.6	5.6	5.2	6.4		7.9	6.8	7.2	3.6	2.7	1.2	0.5	1.3	0.8	0.4
1019H2	1.6	1.9	2.9	0.2	1.2	4.0	5.2	2.4	3.2	0.3	0.1	0.0	0.0	0.0	0.0	0.0
1019H3	2.4	3.4	4.6	0.4	1.3	3.5	5.5	2.8	4.1	0.1	0.03	0.0	0.0	0.0	0.0	0.0
1020H1	2.2	2.8	4.2	2.3	4.9	7.0	8.0	4.3	4.9	4.9	3.7	2.2	0.9	0.7	0.1	0.03
1021H1	0.0	0.05	0.06	0.0	0.05		0.08	1.3	2.1	3.5	2.2	0.6	0.1	2.4	1.9	1.4
1021H2	0.3	1.3	1.4	0.6	1.0	0.9	2.1	2.2	3.1	4.9	2.6	0.9		2.4	1.7	1.3
1115H1	1.3	1.5	2.4	0.5	1.5	3.8	5.5	2.4	3.0	1.1	1.0	0.5	0.3	0.2	0.3	0.1
1116H1										3.5	1.6	0.4	0.03	1.8	1.5	1.3
1116H2										4.2	2.6	0.7	0.1	2.3	1.9	1.6
1116H3										8.6	6.2	1.7	0.07		5.5	5.9
1117H1	1.3	1.5	2.0		0.8	2.4	3.7	1.5	2.1	0.13	0.13	0.15	0.13	0.03	0.06	0.08
1118H1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.2	2.0	1.1	0.2	0.03	1.1	1.0	0.8
1118H2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0		1.1	0.2	0.03	1.0	0.8	0.77

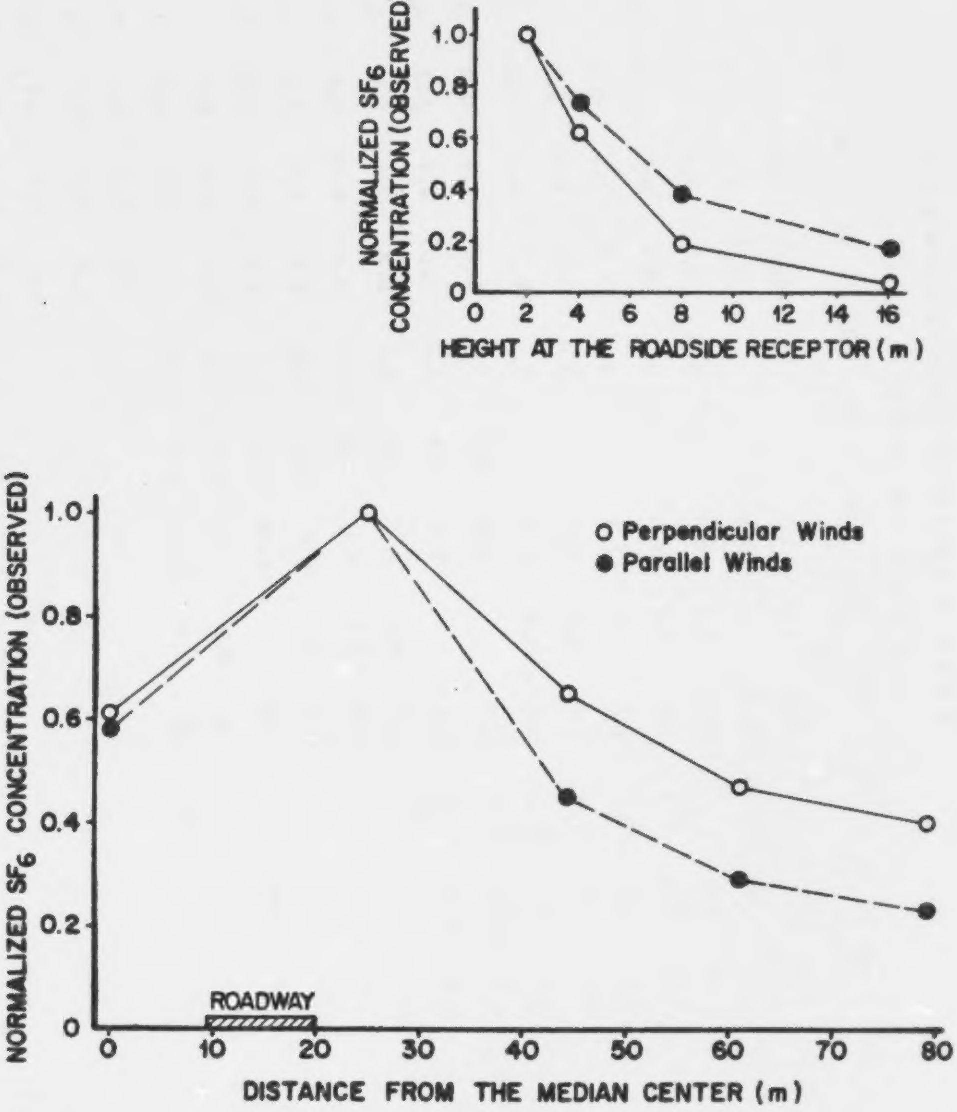


Figure 9 Downwind and vertical profiles of averaged SF$_6$ concentrations normalized by the nearest downwind roadside receptor concentration for perpendicular and parellel wind-road orientations.

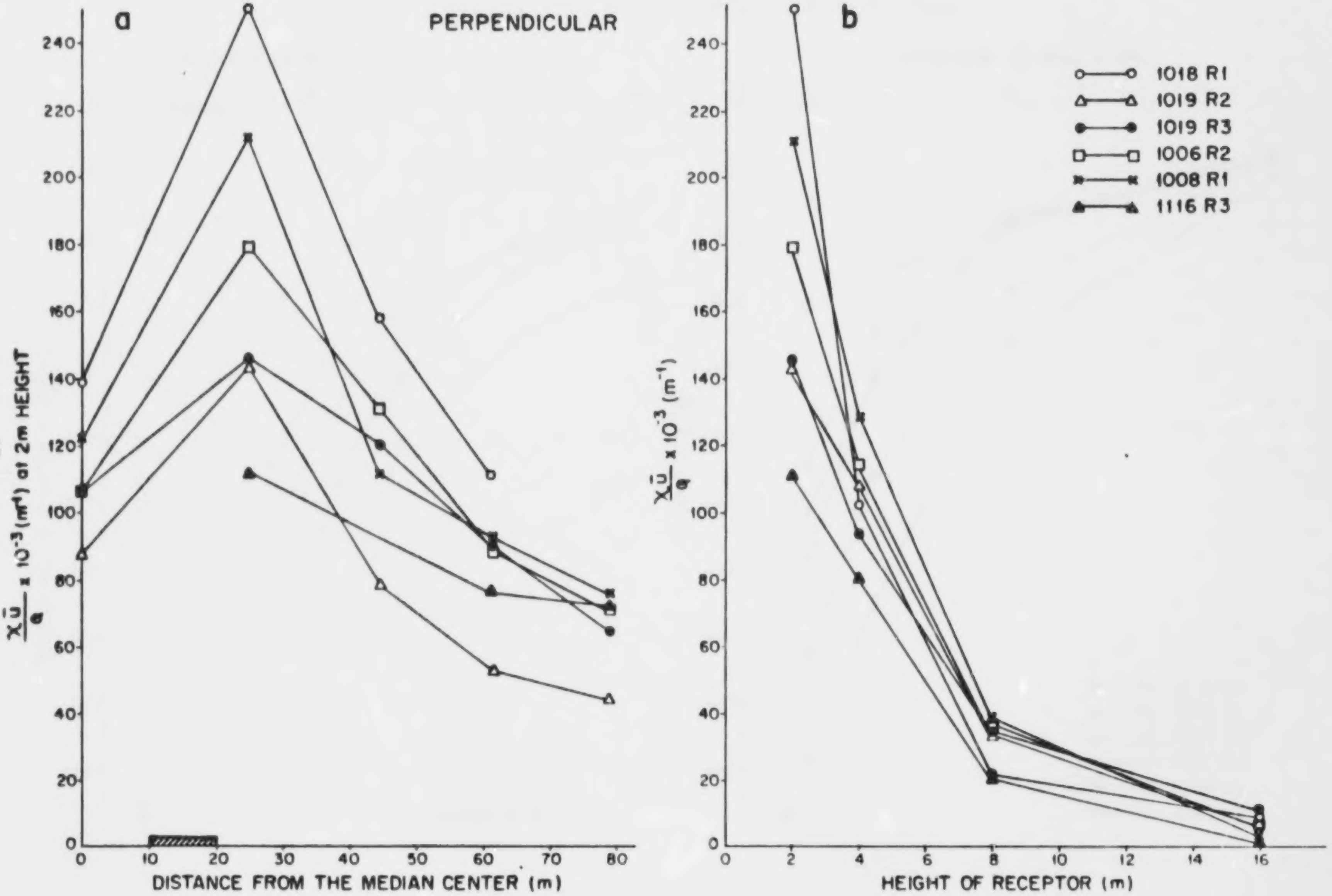


Figure 10a Downwind and vertical profiles of SF_6 concentrations normalized by the emission rate, Q, and mean wind speed, U for perpendicular cases.

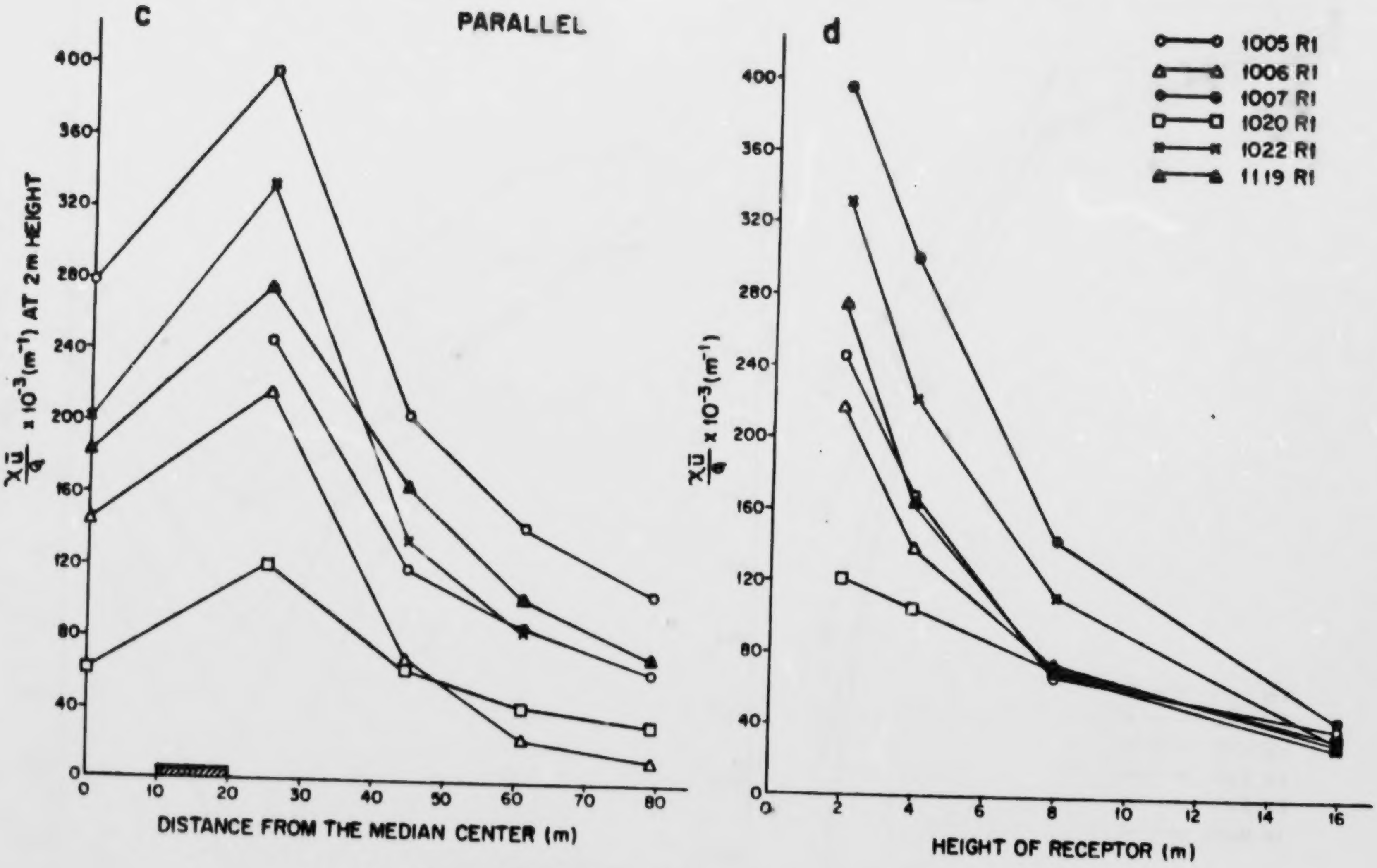


Figure 10b Same as (a) except for parallel cases.

maximum to minimum at a given receptor location is found to be approximately constant in the perpendicular case, while it increases with increasing downwind distance in the parallel case.

The observed variations in the magnitude of the downwind concentrations cannot be attributed to varying atmospheric stability since almost all the tracer runs were conducted under near neutral atmospheric conditions (see Table 3). One possible explanation for the observed variations may be the grouping of the runs according to the wind-road angle (30° spread). The upper and lower bound curves in Fig. 10a correspond to wind-road angles of 64° and 90° respectively. In Fig. 10c, the two extreme curves for parallel winds correspond to westerly (9° with respect to the road) and easterly (8° with respect to the road) and may represent the differing length of emissions input in the two directions. Also, varying flow patterns and diffusivities induced by inhomogeneties in the surface roughness parameter and traffic flow patterns could account for the above variations.

MICROMETEOROLOGICAL DATA

Due to incomplete understanding of dispersion on the microscale, as well as mathematical expediency, various assumptions and simplications are made in the formulation of the dispersion model. It is well known that the microscale structure of atmospheric motions over a homogeneous underlying surface are describable by similarity theories. However, mechanical turbulence generated by the moving vehicles, change in surface roughness, and, perhaps, thermal input from automobile exhaust complicate the flow. In addition, aerodynamic drag along the direction of the moving traffic could have a significant effect on the surface layer structure. Significant deviations from the similarity laws could occur under the above conditions.

While there have been a number of theoretical and experimental studies of flow over homogeneous surfaces, there have been only a few field studies under the complex situations outlined above. The major emphasis of this microscale study was on the evaluation of the influence of the traffic on the turbulent structure of the surface layer. Special attention was given to the identification of the effects of local turbulence sources on the dispersion of pollutants. To this end, time series of wind and temperature were obtained by a three-component sonic anemometer and copper-constantan thermocouples adjacent to the highway. Eddy fluxes of heat and momentum were computed under different atmospheric conditions. Spectral distributions of these parameters were obtained using the Fast Fourier Transform technique. The flow characteristics in the surface layer are inferred from the mean wind profiles adjacent to the highway.

A three-component sonic anemometer, manufactured by Kaijo Denki Ltd. Model 311, was mounted for selected periods of times on towers 2, 9, and 11 at a height of 3m on a 3m extension arm. Temperature fluctuations were measured by ultra fast copper-constantan thermocouples at approximately the center of the sonic antenna. Two wind profiler systems, manufactured by the Thornthwaite Associates, were located on extension arms, 1m away from the tower, at heights of 1.5, 2, 3, 5, 8 and 11m on tower, and of 2, 3, 5, and 8m on tower 3. The constructional and operational details of the sonic anemometer have been described in the literature (see Japan-U.S. Joint Study Group Report, 1971).

Procedures outlined by Kaimal et al (1968) for data acquisition were followed. In particular, corrections for overestimation and zero drift inherent in the instrument were incorporated into the data reduction routine. The signals as well as the output of the Honeywell Accudata amplifier for the Thermocouple temperature fluctuations were recorded on a Honeywell Model 5600 recorder. This recorder, a 14-channel frequency modulated version, has ample frequency response with a 10 to 1 signal to noise ratio. A zero reference voltage was recorded with each run to provide a reference check in the playback mode.

The antenna head of the sonic anemometer was oriented for each run such that the mean wind was centered between the two horizontal pulse paths. A total of 36 hourly runs were obtained with as many different variations of wind direction, atmospheric stability and traffic speed and volume as possible. Analog records of the three wind components (u, v, w) and temperature (T) were digitized by a Hewlett-Packard digital data acquisition system at a sampling rate of 20 readings/second and processed according to the techniques outlined in Czapski and Mumford (1975). Spectra of the three wind components and temperature, and cospectra of u, w and wT were computed using the Fast Fourier Transform technique described by Rao and Ketchum (1975). No corrections for line-averaging (see Kaimal et al, 1968) were made for these spectra since inspection of the computer plots showed little effect in the frequency ranges of interest. Tilt errors and errors due to mean vertical motion were removed, however, following the method given by Hyson et al (1977).

Mean wind profiles were determined by averaging over at least seven consecutive 15 min averages of wind speed at each level. Uniformity of data was ascertained by checking that deviations between individual 15 min samples were paralleled by similar changes at other levels. Also, comparison among wind profiles from different runs under similar conditions of wind direction, stability, and traffic volume were made to ensure the consistency of data.

Of the 36 runs of three-component wind fluctuations analyzed, 22 were selected as representative of different conditions. The fluctuation statistics along with pertinent information on atmospheric stability, traffic speed and volume, wind speed and direction are presented in Table 5. The wind directions tabulated are given with respect to the highway (0^{o} and 180^{o} represent perpendicular wind to the road while 90^{o} and 270^{o} represent parallel wind to the road). Three stability classes are used to describe the atmospheric conditions. These were obtained from the measurements of cloud cover, wind speed, radition and temperature differences recorded at the site.

Spectra and Cospectra

Selected spectra and cospectra showing the influence of traffic are presented in Fig. 11. Fig. 11a presents cospectrum for uw, representing the turbulent transport of momentum or shearing stress, for runs 3 and 11, where run 11 is a case of relatively high traffic compared to run 3 (both cases are with advection from the highway toward the instrument). Both runs are taken in the early morning hours under quite stable atmospheric conditions. Fig. 11b is a spectrum of cross wind fluctuation, v, for the same two runs. The uw cospectrum for runs 7 and 8 are shown in Fig. 11c. In this case, run 8 is a situation with advection from the highway towards the instrument whereas run 7 is not. The spectra of the along-wind component, u, for runs 7 and 8 are shown

TABLE 5 SUMMARY OF THE EXPERIMENTAL CONDITIONS FOR THE SONIC ANEMETER RUNS. $\bar{U}$ IS THE MEAN HORIZONTAL WIND SPEED AND $\bar{W}$ IS THE MEAN VERTICAL SPEED. TET AND TWT ARE THE TOTAL NUMBER OF VEHICLES IN THE EASTBOUND AND WESTBOUND DIRECTIONS, RESPECTIVELY. σ_u AND σ_w ARE THE STANDARD DEVIATIONS OF THE ALONG-WIND AND VERTICAL COMPONENTS OF WIND VELOCITY. $\overline{UW}$ AND $\overline{WT}$ ARE THE SURFACE STRESS AND HEAT FLUX AVERAGED OVER THE SAMPLING PERIOD.

Run No	Date	Time of the Run	Wind Direction W.R.T highway	Stability	$\bar{U}$ cm/sec.	$\bar{W}$ cm/sec.	TET	Average speed of the vehicles (mph)	TWT	Average speed of the vehicles (mph)	Data from Tower	σ_u cm/sec.	σ_w cm/sec.	$-\overline{uw}$	$\overline{wt}$
1	9/24/76	4:30pm	320°	Unstable	162	- .3	1250	35.0	850	48.0	9	93.7	55.0	303	.93
2	9/25/76	3:00pm	155°	Unstable	217	- 5.5	1000	40.0	800	50.0	9	107.6	52.	945	.70
3	10/05/76	3:30am	60°	Stable	226	16.0	60	55.0	30	58.0	9	103.0	43.5	543	--
4	10/05/76	7:00pm	30°	Neutral	306	- 4.8	894	41.2	480	48.5	9	65.1	58.4	449	--
5	10/06/76	12:30am	60°	Neutral	343	- 3.6	320	43.0	102	48.2	9	63.8	49.4	272	--
6	10/06/76	4:30pm	150°	Neutral	163	2.9	1321	32.0	825	48.0	9	57.6	29.6	843	--
7	10/08/76	9:30am	180°	Neutral	329	27.6	607	45.7	933	47.5	9	162.2	85.5	3695	--
8	5/25/77	2:30pm	295°	Neutral	358	19.2	800	44.5	630	47.0	9	118.9	79.7	3451	--
9	5/26/77	2:30am	350°	Stable	332	17.1	120	53.0	38	58.5	9	77.2	48.7	897	--
10	6/04/77	12:15am	350°	Stable	190	33.0	260	47.5	53	49.6	9	69.3	76.9	1319	- .68
11	6/04/77	2:00am	320°	Stable	176	38.0	220	54.0	36	48.6	9	53.2	55.0	1131	-1.41
12	11/17/76	1:00pm	215°	Neutral	232	8.8	628	45.2	564	47.5	2	77.7	46.7	872	.23
13	11/17/76	3:30pm	215°	Neutral	289	15.6	1206	39.5	883	46.7	2	92.9	51.2	1078	.49
14	11/17/76	7:00pm	180°	Neutral	122	- 5.5	893	44.3	440	49.0	2	40.2	25.6	316	- .03
15	11/18/76	3:30pm	285°	Neutral	619	33.3	1226	40.8	821	47.3	2	161.4	49.8	1135	.33
16	11/18/76	9:15pm	285°	Stable	255	11.2	620	48.5	332	48.7	2	122.6	24.7	[illegible]	- .63
17	11/19/76	10:15am	290°	Neutral	471	21.5	518	48.0	727	48.6	2	143.2	54.8	616	--
18	10/08/76	4:15pm	195°	Neutral	270	- 8.7	1241	27.0	404	47.2	11	150.9	26.3	490	--
19	10/20/76	12:30pm	155°	Neutral	135	6.0	532	43.3	548	47.5	11	78.8	44.8	1165	- .14
20	10/21/76	10:45am	300°	Neutral	664	26.0	565	46.0	646	47.4	11	176.1	107.5	2120	.58
21	10/21/76	3:15pm	350°	Neutral	493	31.0	1191	43.0	802	48.0	11	161.0	97.6	2698	.67
22	10/22/76	7:30pm	260°	Stable	193	-19.2	899	44.2	498	48.6	11	69.3	39.4	517	.26

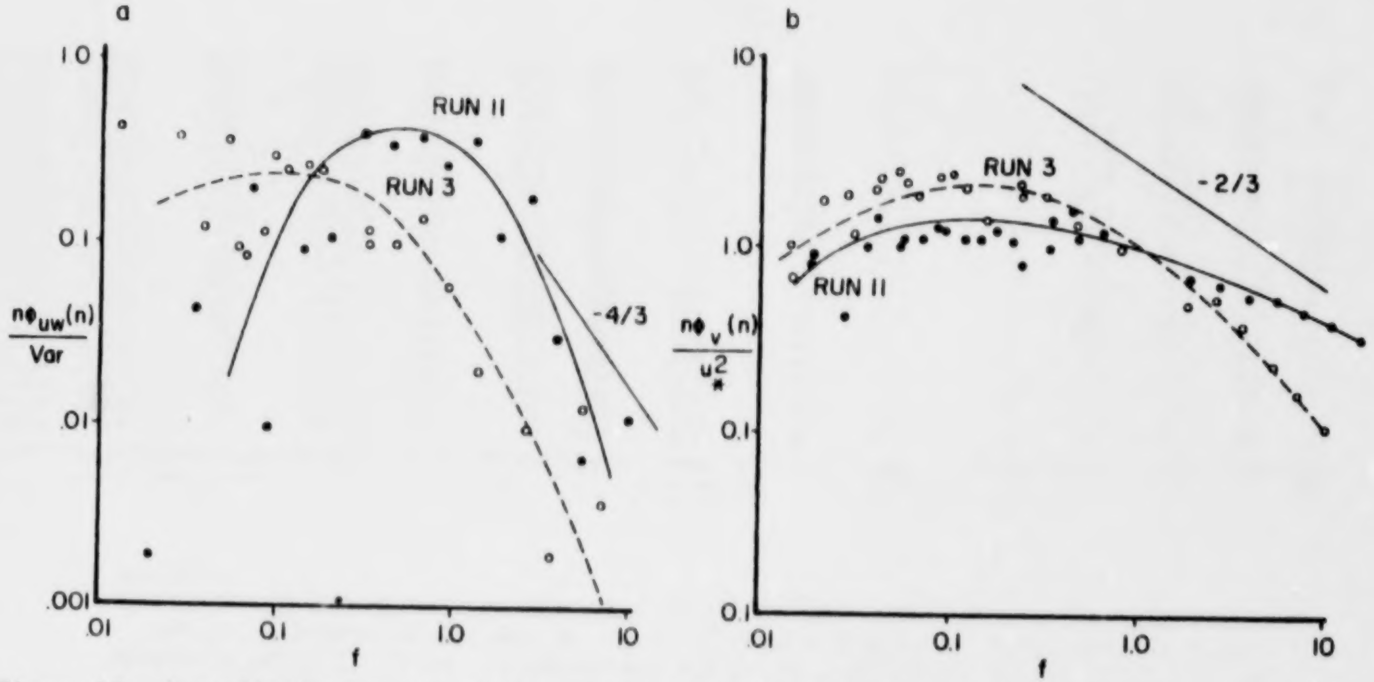


Figure 11a Normalized cospectra of along-wind (u) and vertical wind (w) components for runs 3 and 11 (stable atmospheric conditions). f is the non-dimensional frequency defined as $f = \frac{nz}{\bar{U}}$ where n is the dimensional frequency, z is the height of the measurement, and $\bar{U}$ is the mean wind speed. Run 11 is a case of high traffic compared to run 3. (b) Normalized spectra for the cross-wind (v) component.

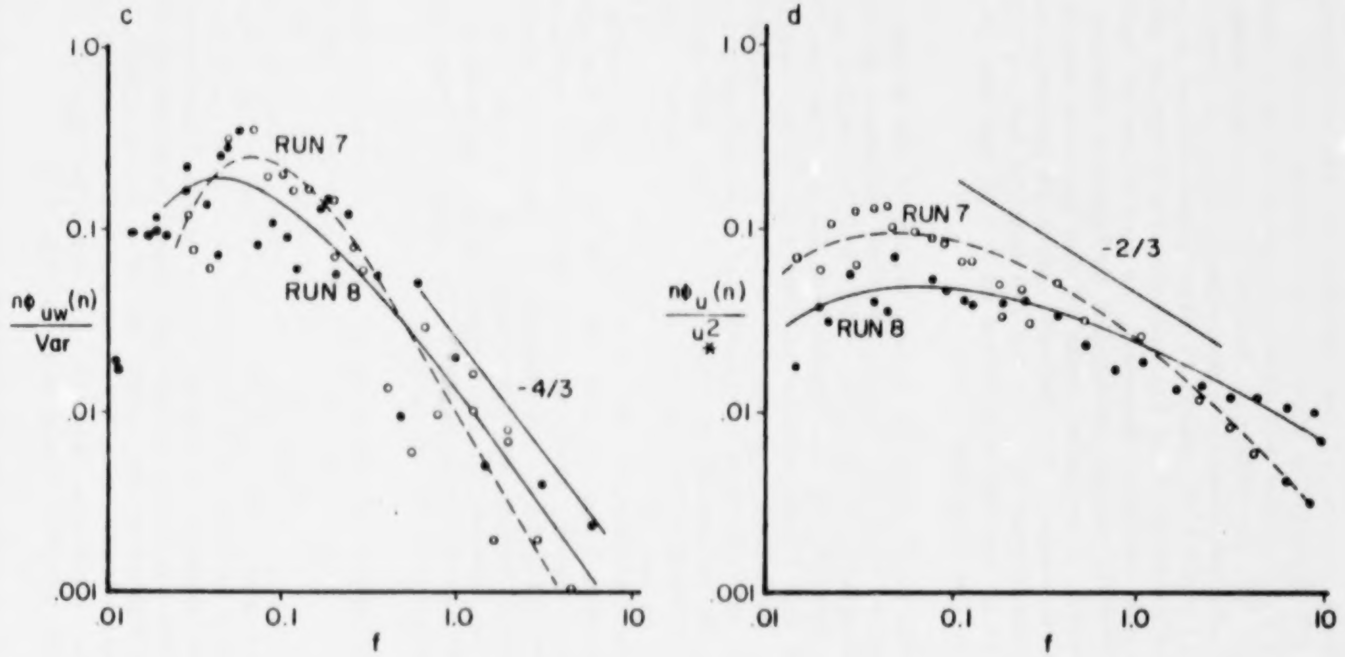


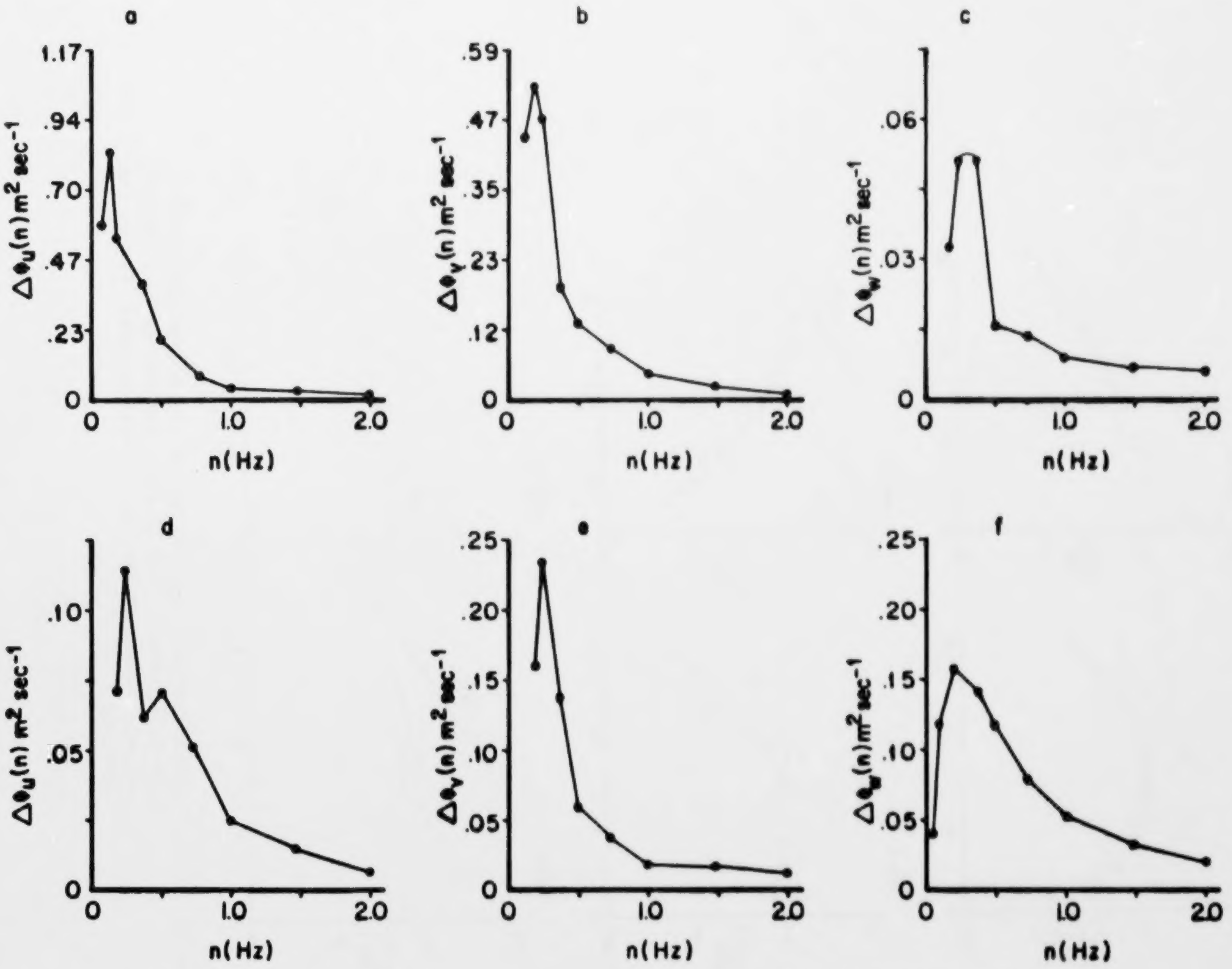
Figure 11c Normalized cospectra of u and w components for runs 7 and 8 (neutral atmospheric conditions). Run 8 is a case of advection from the highway while run 7 is not. (d) Normalized spectra of the along-wind (u) component.

in Fig. 11d. Inspection of these spectra reveals a striking augmentation of the high frequency portion of the variance for the situations where the wind flow has been over relatively high and fast moving traffic. According to the theoretical predictions and observations of surface layer turbulence (Kaimal et al, 1972) and experimental studies of a surface anamoly (Czapski and Mumford, 1975), the maximum spectral power should occur at lower frequencies, when stability is decreased, which is also quite evident in our results. However, the high frequency part of all spectra should nearly coincide under proper non-dimensionalization. Moreover, in conditions of equilibrium between turbulent kinetic energy production by Reynolds stresses and dissipation by viscous forces, an extended range of the spectrum should conform to the laws of inertial subrange. The fall-off rates of spectral power for the inertial subrange, transformed to -2/3 for the spectra and -4/3 for the cospectra when the abscissa is nondimensionalized as $f = \frac{nz}{U}$ and the ordinate as $n\phi(n)$/variance, are drawn in the diagrams.

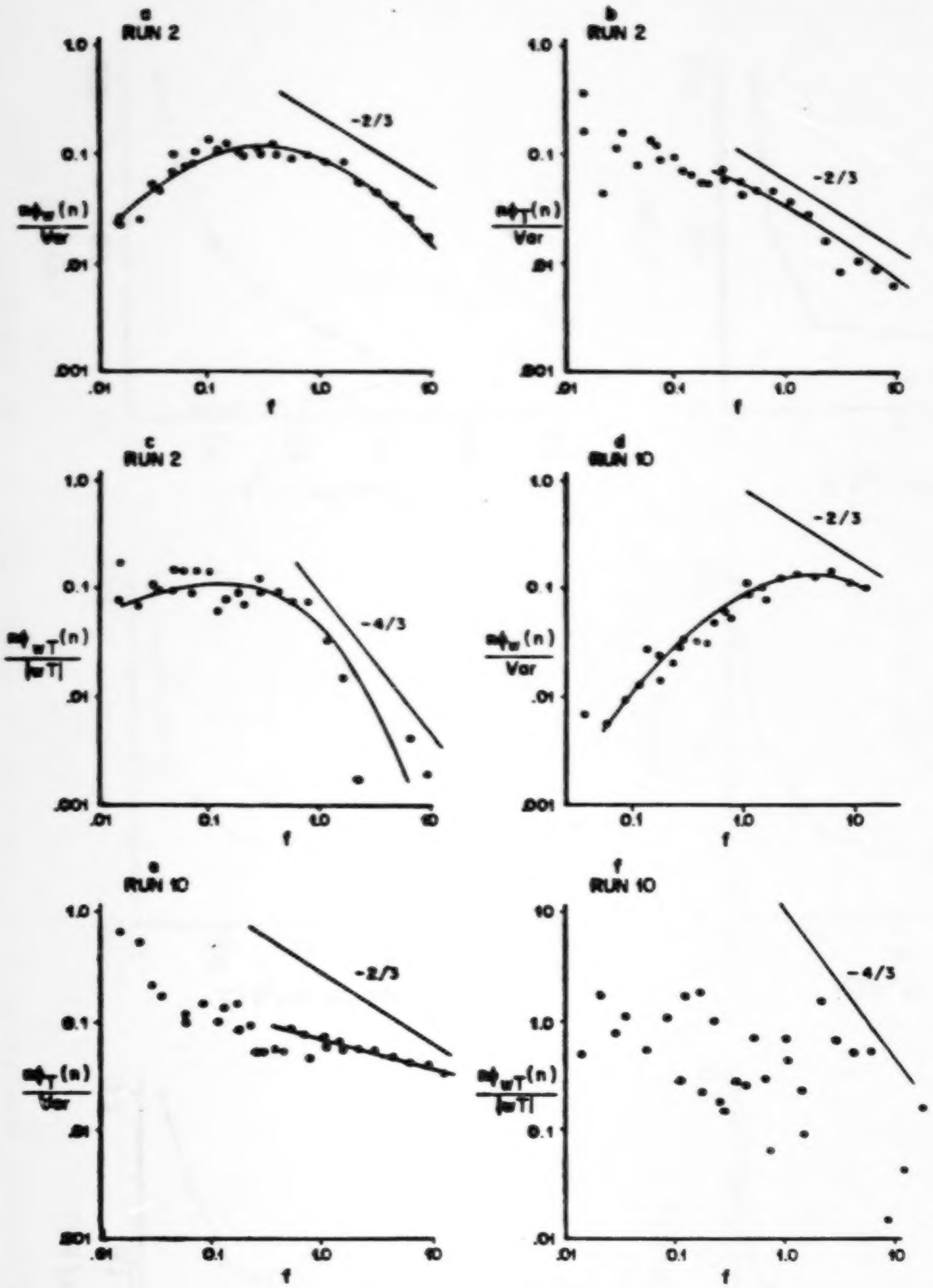
In order to isolate the contribution of the moving traffic to the turbulent energy, spectra with and without traffic influence are compared under otherwise similar atmospheric conditions. The traffic-induced turbulence spectra are derived by subtracting the dimensional energy spectrum for run 2 from run 1. Both runs 1 and 2 have similar ambient atmospheric conditions except that run 1 has traffic influence superimposed on the ambient atmosphere. The spectral differences for all three components of wind velocity for unstable atmospheric conditions are presented in Figs. 12a to 12c. Here $\Delta\phi(n)$, the difference in the energy of each wind component, is plotted against the frequency, n. It is interesting to see that all three difference spectra exhibit a log-normal shape with a maximum difference around 0.25Hz. For the stable case, the difference spectra for runs 3 and 11 (see Figs. 12d to 12f) also show a log-normal type distribution. Again, under neutral atmospheric conditions, the difference spectra were found to be log-normal. A log-normal behavior suggests that the traffic-induced eddies are distributed over a wide size range. This probably is due to the break-up of the larger eddies, introduced by the traffic near 0.25Hz, into smaller size eddies. The range of frequencies affected by the traffic seems to be 0.1 to 1.0Hz.

The difference in the spectral power of vertical component of wind is considerably lower in the unstable case compared to the stable case (see Figs. 12c and 12f). This suggests that the energy input of the traffic-induced turbulence is more significant under stable atmospheric conditions. The interactions across the spectrum of vertical motions induced by buoyancy (larger scale) with motions induced by the local sources could account for the observed predominance of energy in the higher frequencies under stable situations. In non-isotropic turbulence, such interactions are likely to affect a transfer of energy to the larger scales. In the stable case, however, under near isotropic conditions, interactions between motions of similar frequencies could occur. These can lead to a constructive type of interference thereby producing the observed broad peak in Fig. 12f.

Fig. 13 presents the temperature and vertical velocity spectra, and wT cospectra for two selected situations. Run 2 represents an unstable situation with no advection from the highway, whereas run 10 is a stable situation with advection from the highway. The influence of stability on the frequency of maximum spectral power (Fig. 13a against 13d), namely, a shift by one order of



Figures 12a to 12c Difference spectra for u, v, w components, respectively, between unstable case runs 1 and 2. (12d to 12f) Difference spectra for u, v, w components, respectively, between stable case runs 11 and 3.



Figures 13a to 13c. Normalized w, T spectra and wT cospectrum for run 2 (unstable case). (13d to 13f) Normalized w, T spectra and wT cospectrum for run 10 (stable case), Var is the variance of w or T.

magnitude, is distinct. While the temperature spectrum for run 2 (Fig. 13b) conforms to -2/3 law, it is interesting to see that the temperature spectrum for run 10 (Fig. 13e) significantly deviates from the -2/3 relationship. This may be attributed to the traffic-induced turbulence. The covariance between w and T is well organized in the unstable situation (Fig. 13c) compared to the stable case (Fig. 13f). Moreover, as one would expect the heat flux is downwind in the stable situation (see Table 5, run 10) and upward in the unstable case.

If there were significant heat input from automobile exhaust to induce byoyancy, one would expect to observe upward heat flux in any spectral range corresponding to the convective motions. The heat and momentum fluxes are shown together in a semi-log representation for the stable atmospheric conditions in Fig. 14. The overall heat flux for run 11, representative of stable conditions, in Fig. 14a is downward as indicated above. To enable the reader to see how the cospectrum of a situation with well-defined convective elements looks like, this cospectrum is compared to the cospectrum obtained over a heated water plume in Lake Ontario (see Fig. 14b), taken from Czapski and Mumford (1975), when the general conditions over the lake were stable. Examination of Fig. 14b reveals close correspondence of both wT and uw cospectra. In particular, one can readily see that at a given frequency, each positive peak in the wT cospectrum is associated with a negative peak in the uw cospectrum. The implication of this feature is that the same scales, and thus, mechanisms are simultaneously transporting momentum and heat. This indicates the existence of organized convection which occurs at rather well-defined frequencies. Lack of such organization in Fig. 14a suggests that there are no significant convective motions induced due to the waste heat emissions from the automobile exhaust under stable atmospheric conditions. It appears that any heat input from vehicle exhaust is quickly destroyed by the mechanical turbulence generated by the moving traffic.

Mean Wind Profiles

Only simultaneous measurements of wind profiles on both sides of the highway are presented. The wind profiles for all the eleven cases are shown in Fig. 15. Table 6 summarizes the meteorological and traffic data during which the wind profiles were taken. In column 4 of Table 6, one can see that the wind direction on tower 9 at the 2m height varies only between 270° and 330°, whereas at 15m the variation is 265° to 75°. This is obviously due to the channeling effect induced by the moving traffic and the highway configuration.

The most striking effect of the traffic on the wind profiles is the aerodynamic drag of the moving vehicles, and this feature is evident (see Fig. 15) in a comparison of the profiles from tower 9 (5m from the southern edge of the road) with those from tower 3 at a distance of 21m to the north side of the highway. Runs 4, 5, and 6, which represent wind orientations parallel to the road, exhibit strongly accelerated winds at the lower levels of tower 9. At the levels above 8m, the profiles at the two towers tend to become parallel. In the cases of perpendicular flow to the highway (runs 2 and 8), the features are not as pronounced especially with increasing wind speeds.

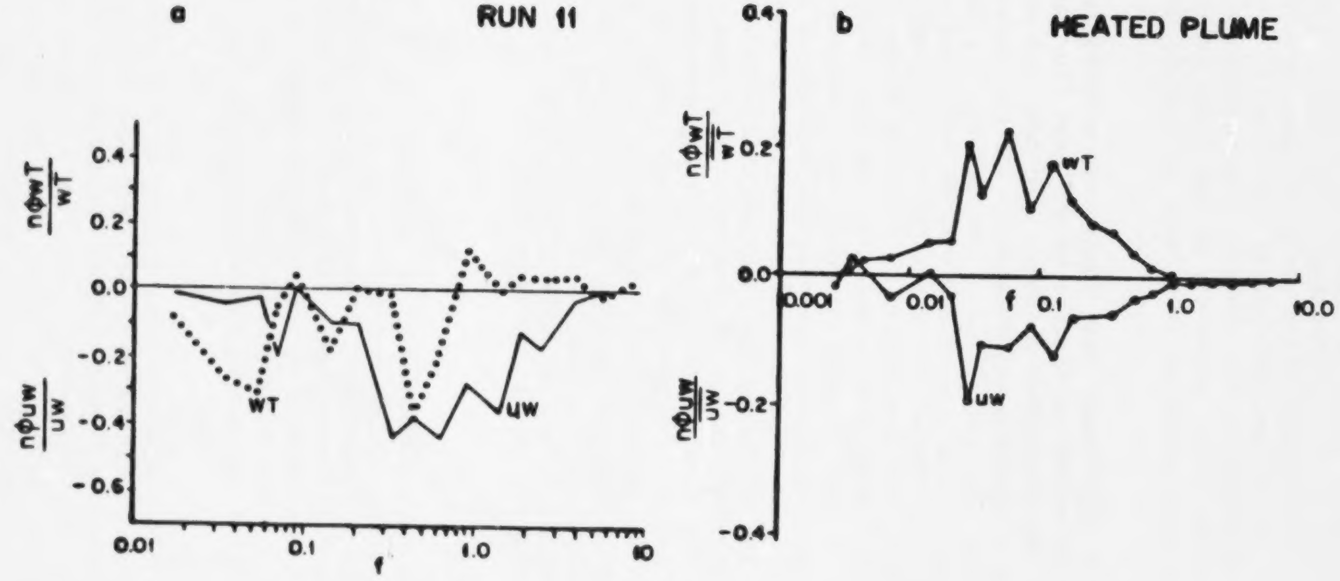


Figure 14a Normalized heat and momentum fluxes for run 11 (stable case) in a semi-log representation. (b) Same as (a) except for heated plume taken over Lake Ontario under stable ambient conditions.

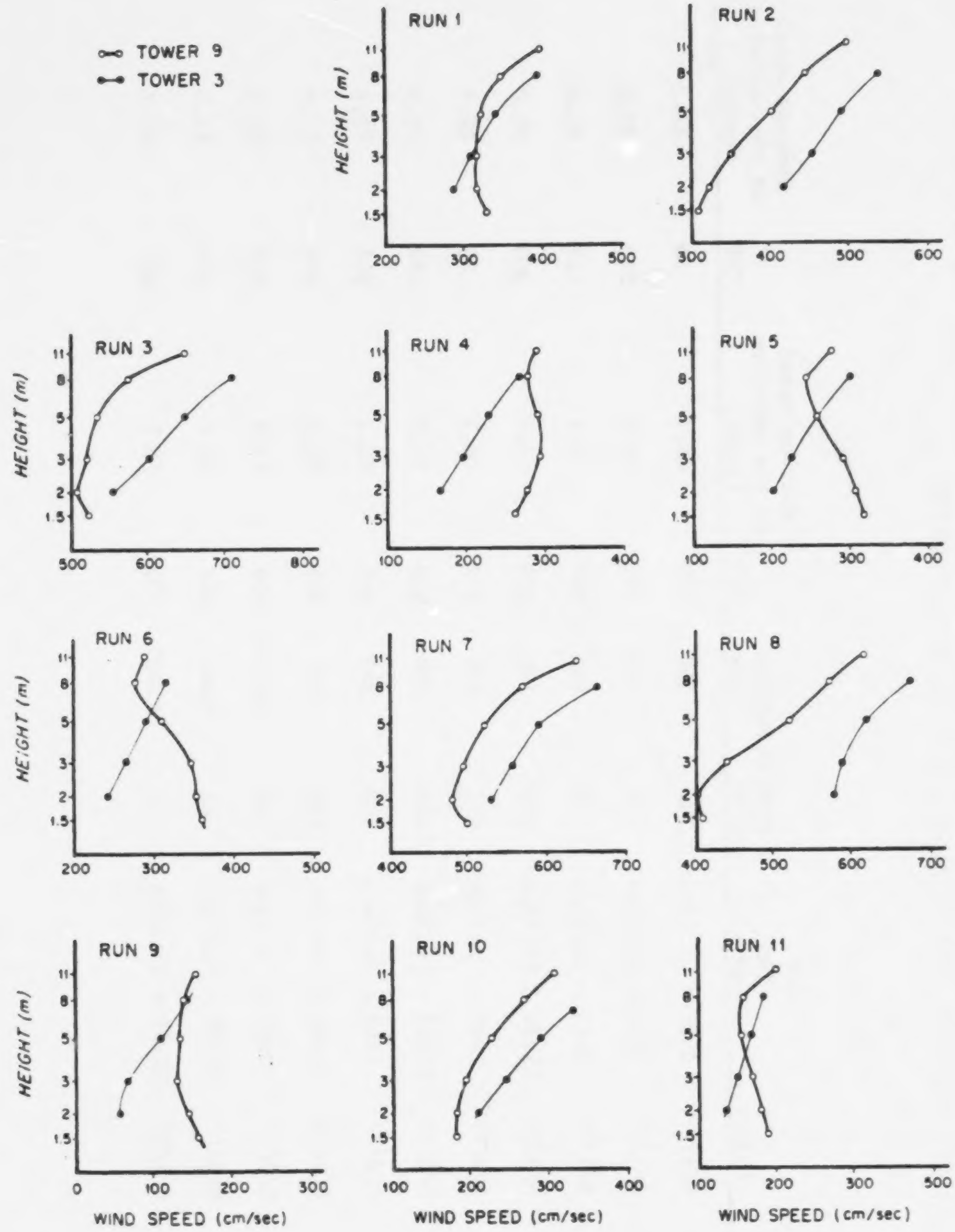


Figure 15 Observed wind profiles for the various runs in Table 6.

TABLE 6 SUMMARY OF EXPERIMENTAL CONDITIONS FOR THE WIND PROFILE RUNS. TET AND TWT ARE THE TOTAL NUMBER OF VEHICLES IN THE EASTBOUND AND WESTBOUND DIRECTIONS, RESPECTIVELY. FLUCT INDICATES THAT THE WIND DIRECTION IS FLUCTUATING

Run No.	Date	Run time interval	Wind Direction		TET	Average speed of the vehicles (km/hr)	TWT	Average speed of the vehicles (km/hr)
			@15m	@2m				
1	6/4/77	2:00 - 2:15pm	320	280	220	80.2	38	78.2
2	6/4/77	9:45 - 10:00am	350	305	765	29.8	365	89.4
3	6/4/77	6:15 - 6:30pm	305	280	568	79.4	427	91.4
4	6/4/77	11:30 - 11:45pm	265	270	510	77.9	200	91.0
5	6/5/77	1:00 - 1:15am	265	270	323	76.3	90	86.6
6	6/5/77	11:15 - 11:30am	280	280	910	77.3	572	91.9
7	6/5/77	1:15 - 1:30pm	305	280	683	79.2	596	92.6
8	6/5/77	4:00 - 4:15pm	350	330	601	81.0	674	92.9
9	6/5/77	8:45 - 9:00pm	30	FLUCT.	606	77.9	616	91.8
10	6/5/77	11:00 - 11:15pm	30	FLUCT.	403	79.7	574	93.1
11	6/6/77	10:00 - 10:15am	75	FLUCT.	550	75.7	401	90.2

The wind speeds at tower 3 are uniformly higher, probably because of its somewhat higher elevation. Runs 1, 3, 7, 9, 10 and 11, representing wind at oblique angles with respect to the highway, show profile distortion to varying degrees.

SECTION 3

MODEL EVALUATION

A dispersion model is a theoretical, mathematical framework which translates emissions and meteorological data into air quality estimates. Since atmospheric motions on the scales of interest for dispersion studies are highly turbulent and influenced by many local factors, development of a mathematical model has always been a complex theoretical problem. Nonetheless, several mathematical models have been formulated to simulate the motor vehicle's impact on air quality based on various assumptions about atmospheric structure. Basically, these models fall into two types; Gaussian and numerical. Gaussian models are based on neglecting any effect of changes in wind speed or direction, or of atmospheric stability over the period of simulation; a so-called "Quasi-steady state atmosphere." In addition, spread of the pollutant plume is assumed to be such that pollutant concentrations vary according to a normal (Gaussian) distribution along both the horizontal and vertical lines perpendicular to the (steady) wind direction. It is also assumed that there is a total reflection of pollutant spread at the earth's surface. The degree of plume spread is denoted by the standard deviations of pollutant concentrations, σ_y and σ_z, which are functions of atmospheric stability and distances from the source. The currently used values of these parameters were determined originally by Gifford (1959), and Pasquill (1961) for open countryside, and by McElroy and Pooler (1968) for urban areas. The values of σ_y and σ_z were determined only to a minimum downwind fetch of 100m, and usually are simply extrapolated to shorter distances as needed. Recently Bowne (1974) presented curves which are projected to 1m downwind according to a value of initial surface roughness. Based on experimental data, Chock (1977) developed sigma curves that are applicable to the dispersion of pollutants from roadways. However, these Gaussian models have several weaknesses and concerns about the limitations of the Gaussian models have led to the development of more sophisticated models, such as numerical models.

Numerical models invoke assumptions which are much less limiting in scope. The conservation of mass equation is solved by finite-difference approximations. These methods may become extremely complex. However, they might eventually lead to a versatile and more accurate model for predicting the transport and diffusion of matter in the atmosphere and are adaptable to the inclusion of chemical reactions. In addition to the mathematical problems associated with the modeling of the diffusion process, lack of sufficient field data has inhibited our understanding of atmospheric motions on this micro-scale. The data gathered in this study are particularly useful to evaluate various mathemetical dispersion models. In this section, the simulation capability of four Gaussian models, viz, HIWAY (Zimmerman and Thompson, 1975), GM (Chock, 1977) AIRPOL4A (Carpenter and Clemaña, 1975), CALINE 2

(Ward et al, 1976); and four numerical models, namely, DANARD (Danard, 1972), MROAD2 (Kirsch and Mason, 1975), RAGLAND (Ragland and Peirce, 1975), and ROADS (Pilter, 1976) are evaluated using the tracer gas data. The dispersion parameters in two of the Gaussian models (GM and HIWAY) are compared to those obtained by solving the Gaussian equation for known source strength, meteorological conditions, and measured concentrations of tracer gas. Finally, the impact of the traffic-induced turbulence on the dispersion of pollutants near highways is discussed.

HIGHWAY MODELS

The various dispersion models tested with the tracer gas data base are briefly described below. A complete description on the formulation of the model can be found in the papers published by the model designers (see above references).

EPA-HIWAY Model

The HIWAY model uses multiple evaluation of a steady state Gaussian equation to predict air pollution concentrations at receptor locations adjacent to a highway in a relatively flat terrain. A highway is simulated with an increasing number of point sources with the total contribution of all points computed by a trapezoidal integration of the Gaussian point source equation over a finite length until the solution converges. The concentration from a line source is given by

$$C = \frac{q}{U} \int_0^D f \, dl$$

where q is the emission rate per unit length, U is the wind speed, D is the length of the line source and f is the point source dispersion function. The dispersion parameters σ_y and σ_z in the Gaussian plume equation are specified at each downwind distance as a function of atmospheric stability and distance. Mechanical mixing over the highway is simulated by specifying a set of initial dispersion parameters.

California - CALINE2 Model

This model is based on the Gaussian plume theory together with concepts of a box model. It uses a separate equation for computing pollutant concenrations under cross-wind and parallel-wind to the highway configurations. The model assumes that the pollutants are well mixed over the roadway up to a fixed height. This region is referred to as the "mixing cell." The downwind concentrations from the roadway are determined by using both continuous line source and continuous point source equations. The model uses Pasquill dispersion parameter curves which are modified to handle downwind distances of less than 100m from the source.

AIRPOL-4A Model

This model adopts the technique of segmentation in conjunction with an appropriate numerical method to evaluate the Gaussian integral. The model is capable of predicting concentrations for both upwind as well as downwind of a roadway at any desired sampling intervals for wind speeds greater than or equal to zero.

General Motors (GM) Model

This model uses an infinite Gaussian line source approach. Pollutant concentrations are computed from the equation

$$C = \frac{Q}{\sqrt{2\pi}\, U_1 \sigma_z} \left\{ \exp\left[-\frac{1}{2}\left(\frac{z + H_0}{\sigma_z}\right)^2 \right] + \exp\left[-\frac{1}{2}\left(\frac{z - H_0}{\sigma_z}\right)^2 \right] \right\}$$

Here Q is the emission rate per unit length, U_1 is a sum of effective cross-road wind speed and wind speed correction factor, H_0 is the plume height. The effect of lateral and vertical dispersion on the distribution of concentration is incorporated by specifying σ_z as a function of both downwind distance and wind-road orientation angle. Chock (1977) suggests that σ_z is of the form $\sigma_z = (a + bx)^c$ where a, b, c are functions of atmospheric stability, which are determined empirically, and x is the distance from the source.

MROAD 2 Model

This is an Eulerian two-dimensional grid model which numerically solves the conservation of mass equation. The model allows for the existence of several line sources (all assumed to be perpendicular to the plane in the model) including elevated highways. There is also a provision to include topography adjacent to the roadway. Mixing of pollutants is assumed to be uniform to 3.3m above each road bed. Wind profiles are described as a function of atmospheric stability, but can be specified by the user. The model can accept wind direction and speed for up to eight locations. The final wind field is based on the solution of a potential field and is fitted to the measured velocities via a least-squares fit.

DANARD Model

DANARD is a two-dimensional Eulerian model which solves the mass conservation equation according to the numerical methods outlined by Dufort and Frankel (1953). The grid is fixed in the horizontal, extending from -150m to +150m from the center of the roadway. The vertical grid is confined to 10 cells between the surface (assumed flat) and the mixing height. The pollutants are assumed to be mixed uniformly within the 3m layer above the roadway, but the user can specify the diffusivity value desired over the highway (Danard suggests a value of $20 m^2$/sec). The user must also specify the diffusivities (K_x, K_z) at the 10m height. Model inputs include a wind speed value V at the 10m height and a cross-road component at the same level. If the mixing height is greater than 10m, the model requires additional wind measurements at higher levels.

This model has been modified to accommodate mixing over 3 lanes in each direction with a wide median as required by our experimental site. Fig. 16

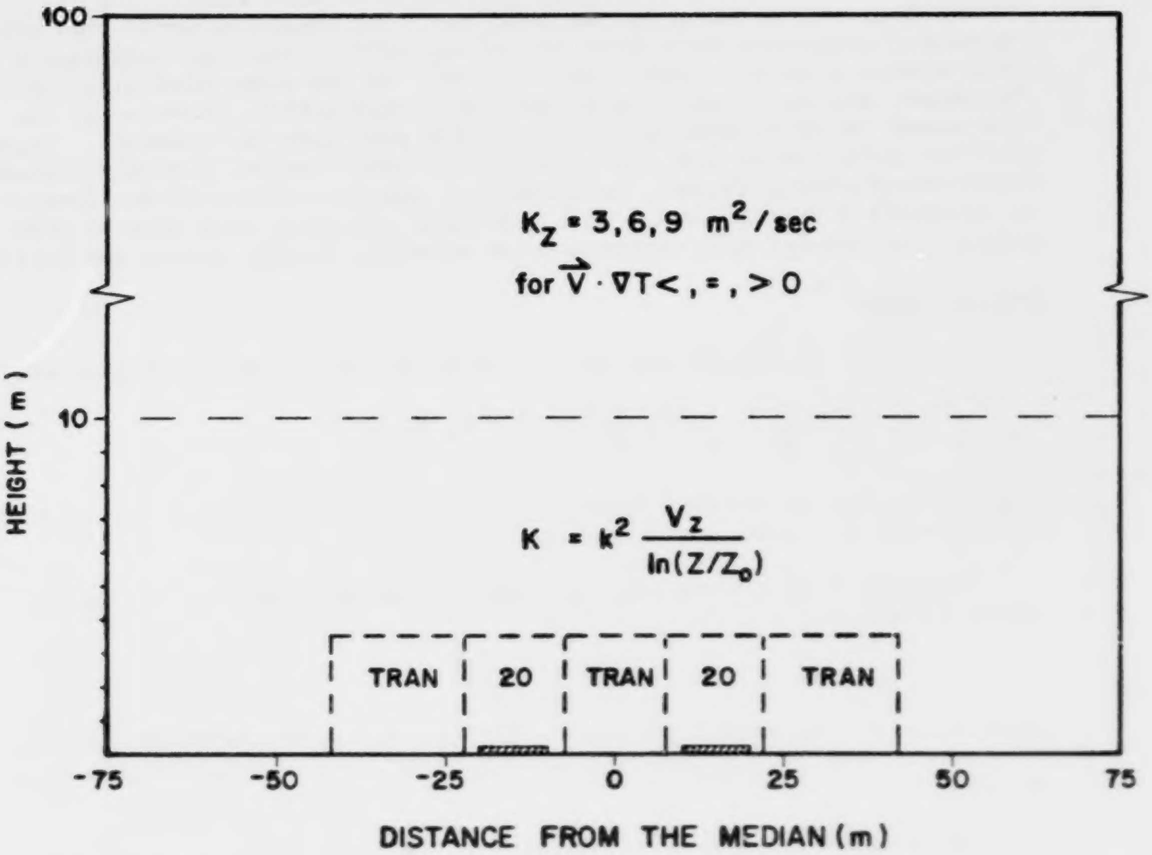

100
10
HEIGHT (m)
$K_Z = 3,6,9\ m^2/sec$
for $\vec{V} \cdot \nabla T <, =, > 0$
$K = k^2 \frac{V_z}{\ln(Z/Z_o)}$
TRAN
20
TRAN
20
TRAN
-75
-50
-25
0
25
50
75
DISTANCE FROM THE MEDIAN (m)

Figure 16 DANARD model layout. Included in the diagram is the distribution of diffusivity values (as suggested by Danard, 1972) used in this study. $\bar{V} \cdot \Delta T$ represents temperature advection.

shows the model layout with the K_z values suggested by Danard. There are three lanes over which $K_x = K_z = 20m^2/sec$ with corresponding linear transition zones. The source terms are allowed to exist only at two grid points corresponding to the middle lanes of the two directions.

The model is designed to iterate until the outflow of pollutants from the model is within a critical percentage of the influx from the roadway. Unfortunately, this technique is not found to be sufficient for use in this study. Therefore, the model is allowed to iterate until the outflow converged to a constant value. This constant is found to be always larger than the inflow. The magnitude of the excess outflow is between 1-4% and found to be a function of cross-road wind speed and the total wind speed. Fig. 17 demonstrates this relationship for our test runs. It should be noted that with increasing cross-road wind speed the excess outflow value at convergence tends toward a value between 2.4% and 2.8%. At low cross-road wind speeds the excess outflow value is quite variable, apparently a function of the total wind speed (which determines K_z for $z < 10m$ away from the roadway). Danard does not permit cross-road wind speeds less than 1 m/sec, probably because of these convergence problems. Interestingly enough, using only one lane as set up in Danard's original model with emissions extending over several grid points, the results will converge to an equality between influx and outflow.

RAGLAND Model

The model of Ragland and Peirce (1975) solves the continuity equation

$$u \frac{\partial c}{\partial x} - \frac{\partial}{\partial y}\left(K_y \frac{\partial c}{\partial y}\right) - \frac{\partial}{\partial z}\left(K_z \frac{\partial c}{\partial z}\right) = 0$$

Where $u = u\ (z)$ is the wind speed in the x direction as a function of height and c is the pollutant concentration.

The eddy diffusivities are defined for neutral stability following Lettau (1959) as

$$K_z = k\ u_*\ z \quad \text{for } z \leq 100m$$

where k is the von Karman constant (0.4) and u_* is the friction velocity defined in terms of the geostrophic drag coefficient and geostrophic wind speed.

The continuity equation is solved for two cases using an efficient matrix inversion technique under the same boundary conditions as imposed by Danard (1972) except that Danard's cross-road diffusivity value K_x is replaced by the more appropriate cross-wind diffusivity K_y. The model predicts for oblique and perpendicular cases by ignoring lateral diffusion $\left(K_y \frac{\partial c}{\partial y}\right)$ and computing an effective advective wind speed equal to V Sin ϕ. In the parallel case the model solves the equation in three-dimensions including lateral diffusion.

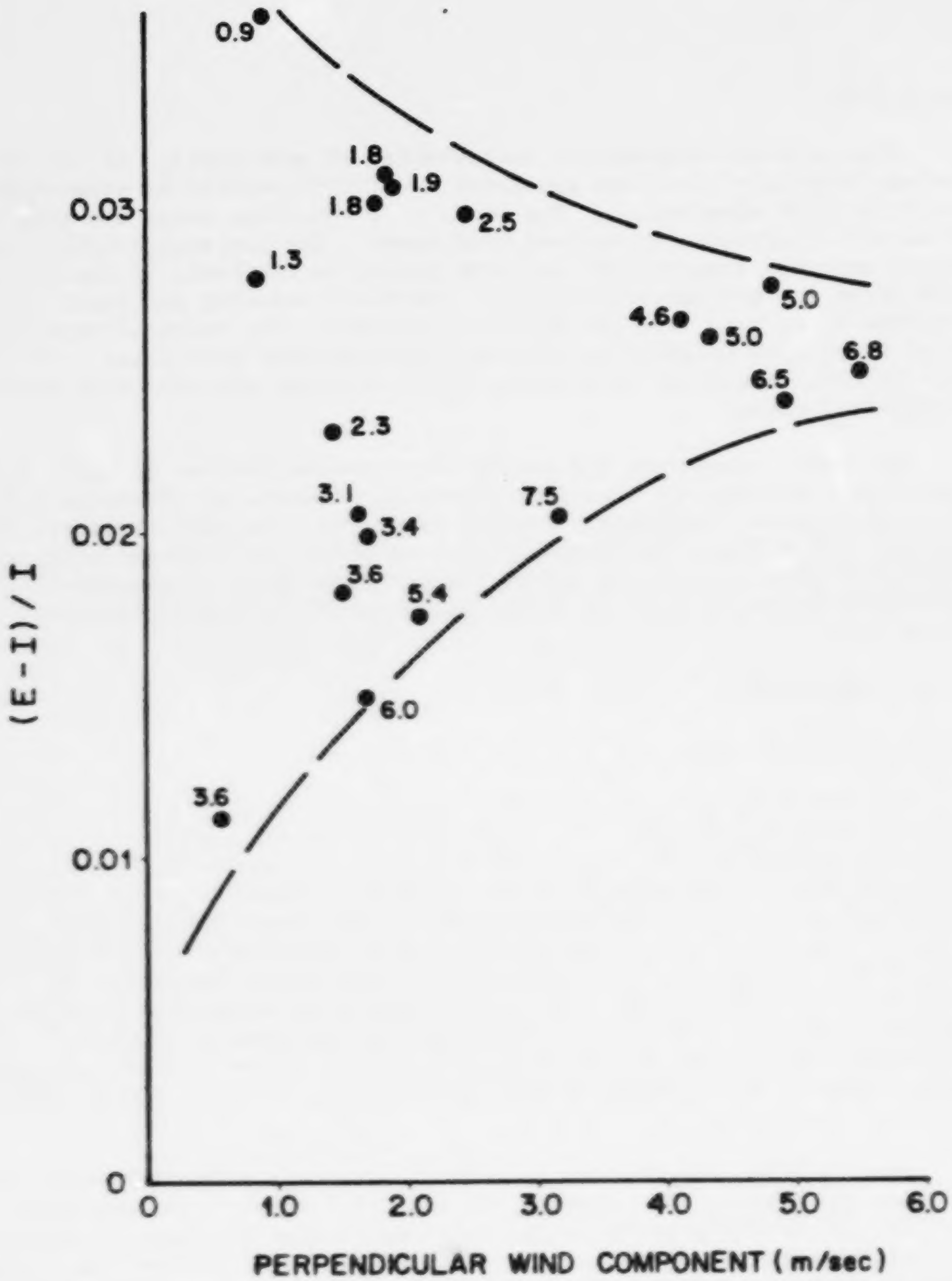


Figure 17 Convergence values for DANARD model as a function of cross-road wind speed. The model efflux, E, was always greater than model influx, I, at convergence. The numbers next to the date points represent total wind speed for the run and indicate that the scatter is influenced by the magnitude of K_z which is a function of total wind speed below 10m and outside of the mixing cell.

ROADS Model

This is a two-dimensional conservation of mass model. It computes the average stability class and generates a vertical profile of cross-road wind speed for each observation. The winds at a reference level are then averaged to obtain a reference cross-road wind speed. The horizontal cross-road wind speeds are then computed for all grid points on the basis of the reference wind speed and the vertical profile. Vertical velocity generated due to the presence of terrain features are also computed. The vertical velocities, which decay with height, are then specified at each grid point. The horizontal velocity departures from these values are also adjusted with distance in a specified manner.

The model determines the steady-state concentrations of pollutants by numerically solving the equations governing atmospheric advection and diffusion and chemical reactions. In each time step, the pollutants are first advected and diffused horizontally then advected and diffused vertically, and finally allowed to react to modify the pollutant mix. Lax-Wendroff finite-difference scheme is used to solve the advection-diffusion equation numerically.

MODEL PREDICTIONS

Tracer Gas (SF_6) Data

All the eight models, described above, were used to predict concentrations at downwind receptors corresponding to the SF_6 sampling points. Stability estimates made from Islip airport data (about 25km from the site) indicated most tracer periods to be in neutral stability while stability parameters such as bulk Richardson number, wind angle fluctuations, and vertical temperature gradients based on data observed at the site indicated most of the run periods to be in unstable conditions (See Table 3). This would seem to indicate that the locally generated turbulence modifies the ambient conditions and tends to decrease the atmospheric stability. All the dispersion models were run for both neutral and unstable stability conditions (stabilities 4 and 2, respectively, according to Pasquill-Turner classification).

The SF_6 runs were divided into three sets; perpendicular (wind 60° to 90° from the axis of the highway), oblique (30° to 60° from the axis), and parallel (0° to 30° from the axis). For each classification of wind-road orientation, linear regression analysis was performed between the measured concentrations and those predicted by each model. The results of these ensemble regressions for Gaussian and numerical models are listed in Tables 7 and 8, respectively, which show the explained variance (r^2), the slope (b), the intercept (a), and the standard error of estimate ($S_{O/P}$) for observed (O) versus predicted (P). In the case of the DANARD model, only results of the neutral case are presented in Table 8 since there is little change in the predicted concentrations between neutral and unstable categories. The total sample size, N, of 133 has a critical correlation $r_{crit,\ C.01}$ at the 1% level of 0.22. Thus, all the models are highly correlated with the data which

TABLE 7 STATISTICAL RESULTS OF LINEAR REGRESSION BETWEEN OBSERVED SF_6 CONCENTRATIONS AND PREDICTED CONCENTRATIONS OF GAUSSION MODELS FOR PERPENDICULAR (A), OBLIQUE (B), AND PARALLEL (C) WIND-ROAD ORIENTATION ANGLES. STATISTICAL PARAMETERS ARE: EXPLAINED VARIANCE (r^2), SLOPE (b), INTERCEPT (a), AND STANDARD ERROR OF ESTIMATE FOR OBSERVED TO PREDICTED ($S_{o/p}$). N IS THE SAMPLE SIZE

Wind-Road Angle	Statistical Parameter	HIWAY		GM		CALINE 2		AIRPOL-4A	
		Neutral	Unstable	Neutral	Unstable	Neutral	Unstable	Neutral	Unstable
A	r^2	0.73	0.87	0.88	0.86	0.74	0.66	0.61	0.70
	b	0.45	0.71	0.91	1.01	1.07	1.16	1.09	1.93
(N=41)	a	0.95	0.61	0.43	0.44	0.03	0.31	0.38	-0.28
	$s_{o/p}$	1.09	0.76	0.73	0.78	1.07	1.23	0.34	1.18
B	r^2	0.55	0.74	0.75	0.76	0.51	0.52	0.66	0.78
	b	0.42	0.76	0.88	1.01	0.54	1.49	0.90	2.22
(N=53)	a	0.70	0.32	0.24	0.26	0.25	-0.03	0.05	-0.72
	$s_{o/p}$	1.15	0.88	0.85	0.84	1.20	1.19	1.00	0.81
C	r^2	0.50	0.67	0.89	0.92	0.49	0.45	0.72	0.69
	b	0.14	0.40	0.71	0.91	0.29	0.83	0.65	1.68
(N=39)	a	1.92	1.33	0.32	0.45	1.21	1.11	0.56	0.42
	$s_{o/p}$	1.65	1.34	0.76	0.64	1.68	1.74	1.24	1.31
All	r^2	0.45	0.70	0.83	0.86	0.41	0.54	0.62	0.72
	b	0.19	0.52	0.76	0.96	0.34	1.03	0.73	1.91
(N=133)	a	1.67	0.97	0.48	0.39	1.25	0.61	0.62	-0.19
	$s_{o/p}$	1.53	1.13	0.86	0.77	1.58	1.40	1.29	1.10

TABLE 8 SAME AS TABLE 7 EXCEPT FOR NUMERICAL MODELS. RUN 1020R1 IN NOT INCLUDED IN THE MODEL EVALUATION BECAUSE OF CONVERGENCE PROBLEMS

Wind-Road Angle	Statistical Parameter	DANARD	MROAD 2		RAGLAND		ROADS	
		Neutral	Neutral	Unstable	Neutral	Unstable	Neutral	Unstable
A	r^2	0.85	0.83	0.70	0.77	0.35	0.84	0.82
	b	0.63	0.58	1.00	0.41	0.53	0.23	0.59
(N=41)	a	0.23	0.43	0.50	0.93	1.26	0.63	0.21
	$s_{o/p}$	0.82	0.86	1.15	1.00	1.71	0.85	0.90
B	r^2	0.73	0.70	0.67	0.47	0.53	0.64	0.62
	b	0.72	0.70	1.37	0.27	0.35	0.26	0.67
(N=53)	a	0.02	0.13	0.19	0.92	0.74	0.37	-0.04
	$s_{o/p}$	0.89	0.94	0.98	1.25	1.17	1.02	1.06
C	r^2	0.72	0.72	0.72	0.63	0.63	0.59	0.33
	b	0.58	0.56	1.21	0.25	0.29	0.20	0.28
(N=32)	a	0.06	0.54	0.82	1.34	1.37	0.63	1.05
	$s_{o/p}$	1.22	1.20	1.21	1.39	1.41	1.47	1.89
All	r^2	0.76	0.76	0.67	0.60	0.44	0.70	0.50
	b	0.61	0.60	1.12	0.30	0.32	0.22	0.40
(N=126)	a	0.22	0.40	0.56	1.08	1.30	0.59	0.76
	$s_{o/p}$	0.98	0.98	1.14	1.27	1.51	1.11	1.42

reflects the trivial result that all models predict decreasing concentrations away from the highway as observations indicate. A comparison of explained variance from model to model, however, illustrates the relative ability of each model to reproduce the observed concentration field.

Summarizing Table 7, it is evident that the GM model performed the best for this set of data. It showed the highest explanation of variance (r^2) and had a slope close to unity for all cases when unstable stability was used. In general, all models predicted best for the perpendicular case which should be expected since this is the simplest case where the magnitude of diffusion terms become less important. The comparison of parallel wind cases indicated that the GM model predictions are markedly better than predictions of the other models. The numerical models in all cases did no better than the Gaussian models (see Table 8) for this simple roadway configuration. It is interesting to see that while Gaussian models gave good correlation when unstable classification is used, the numerical models yield good correlation for neutral stability classification. This suggests that the eddy diffusivity values in the numerical models and dispersion parameters in the Gaussian models need further examination.

The simulation capability of the advection-diffusion process of each of these models could be evaluated by comparing the normalized downwind concentrations to their corresponding model predictions. The predicted and observed concentrations for each run were normalized by its corresponding maximum concentration per run, thus removing the model's dependence on wind speed and emission rate. Tables 9 and 10 list the results of the linear regression between the observed and predicted normalized concentrations after eliminating mutual values of unity. When all the data are considered, HIWAY, GM, DANARD, and MROAD2 fit the observed profile data well. This implies that the dispersion formulations used in these models are more consistent with the ambient conditions at the site. The ratio of predicted to observed concentration for the nearest downwind road side receptor for the eight models are listed in Tables 11 and 12. Since the nearest downwind road side receptor has the highest concentration, the minimum and maximum ratios in Tables 11 and 12 provide a range of under to over prediction for each model. In particular, in the case of HIWAY for neutral stability the range is a factor of 6 between minimum and maximum values (for parallel wind cases), while in the case of GM model it is only 1.5.

The simulation capability of each of the Gaussian models tested is summarized in Figs. 18 to 21. The scatter plot showing the HIWAY model prediction and measurement is indicated in Figs. 18a and b. A one-to-one correspondence line (observed = predicted) is drawn in the diagram to facilitate comparison between observed and predicted. As indicated earlier, the HIWAY model using unstable stability (Fig. 18a) predicts concentrations quite well for perpendicular and oblique wind-road angles. The model tends to overpredict in the parallel wind situations. The GM model predictions shown in Figs. 19a and b are in excellent agreement with measurements. In particular, the model predicts best for parallel wind conditions. CALINE2 model is seen (Fig. 20a) to consistently underpredict independent of the wind-road orientation angle using stability 2. For stability 4, the model tends to underpredict

TABLE 9 STATISTICAL RESULTS OF LINEAR REGRESSIONS BETWEEN NORMALIZED MEASURED CONCENTRATIONS AND THE CORRESPONDING NORMALIZED PREDICTIONS OF GAUSSIAN MODELS

Wind-Road Angle	Statistical Parameter	HIWAY		GM		CALINE 2		AIRPOL-4A	
		Neutral	Unstable	Neutral	Unstable	Neutral	Unstable	Neutral	Unstable
A	r^2	0.57	0.80	0.76	0.74	0.67	0.57	0.59	0.56
	b	0.53	0.93	0.85	0.83	0.87	0.87	0.56	0.74
(N=35)	a	0.16	0.03	0.07	0.09	-0.13	-0.12	0.10	0.01
	$s_{o/p}$	0.17	0.11	0.12	0.13	0.14	0.17	0.17	0.17
B	r^2	0.45	0.82	0.76	0.76	0.30	0.41	0.69	0.74
	b	0.52	1.02	0.89	0.92	0.58	0.85	0.63	0.89
(N=40)	a	0.17	-0.02	0.04	0.06	0.02	-0.18	0.07	-0.10
	$s_{o/p}$	0.16	0.09	0.11	0.11	0.18	0.17	0.12	0.11
C	r^2	0.66	0.79	0.91	0.91	0.55	0.59	0.78	0.78
	b	0.72	0.90	0.87	0.91	0.70	0.95	0.69	0.86
(N=33)	a	0.12	0.03	0.04	0.05	-0.06	-0.29	0.05	-0.09
	$s_{o/p}$	0.12	0.09	0.06	0.06	0.14	0.13	0.10	0.10
All	r^2	0.54	0.80	0.79	0.79	0.49	0.48	0.67	0.67
	b	0.56	0.95	0.87	0.88	0.72	0.81	0.61	0.80
(N=108)	a	0.16	0.02	0.05	0.07	-0.06	-0.14	0.08	-0.04
	$s_{o/p}$	0.15	0.10	0.10	0.10	0.16	0.16	0.13	0.13

TABLE 10 SAME AS TABLE 9 EXCEPT FOR NUMERICAL MODELS

Wind-Road Angle	Statistical Parameter	DANARD	MROAD 2		RAGLAND		ROADS	
		Neutral	Neutral	Unstable	Neutral	Unstable	Neutral	Unstable
A (N=35)	r^2	0.80	0.80	0.60	0.58	0.35	0.72	0.80
	b	0.92	0.91	0.81	0.72	0.55	0.74	1.0
	a	-0.04	-0.04	-0.03	0.14	0.17	0.08	-0.11
	$s_{o/p}$	0.11	0.11	0.15	0.16	0.21	0.13	0.11
B (N=40)	r^2	0.78	0.78	0.53	0.28	0.32	0.64	0.74
	b	0.89	0.84	0.66	0.43	0.49	0.70	1.12
	a	-0.06	-0.05	0.05	0.24	0.22	0.07	-0.27
	$s_{o/p}$	0.10	0.10	0.14	0.18	0.18	0.13	0.11
C (N=27)	r^2	0.85	0.82	0.61	0.35	0.36	0.68	0.55
	b	0.87	0.70	0.51	0.50	0.47	0.75	1.10
	a	-0.12	0.02	0.14	0.23	0.24	-0.03	-0.43
	$s_{o/p}$	0.08	0.08	0.12	0.16	0.16	0.11	0.13
All (N=102)	r^2	0.77	0.78	0.56	0.40	0.35	0.65	0.51
	b	0.87	0.82	0.65	0.55	0.50	0.70	0.77
	a	-0.05	-0.02	0.06	0.20	0.21	0.06	-0.07
	$s_{o/p}$	0.11	0.10	0.14	0.17	0.18	0.13	0.15

TABLE 11 RATIO OF PREDICTED TO OBSERVED CONCENTRATIONS AT THE ROADSIDE RECEPTOR FOR EACH GAUSSIAN MODEL AS A FUNCTION OF WIND-ROAD ORIENTATION ANGLE. NUMBERS GREATER THAN UNITY INDICATE OVER-PREDICTION BY THE MODEL

Wind-Road Angle	Ratio of Predicted to Observed	HIWAY		GM		CALINE-2		AIRPOL-4A	
		Neutral	Unstable	Neutral	Unstable	Neutral	Unstable	Neutral	Unstable
A	Maximum	1.97	1.59	1.15	1.06	0.94	0.82	0.78	0.64
	Minimum	0.84	0.68	0.68	0.68	0.53	0.34	0.62	0.42
(N=6)	Average	1.36	1.11	0.95	0.88	0.68	0.56	0.65	0.48
B	Maximum	2.40	1.64	1.31	1.30	1.68	0.59	1.26	0.61
	Minimum	0.89	0.63	0.66	0.63	0.64	0.25	0.64	0.32
(N=7)	Average	1.55	1.16	1.03	0.95	1.13	0.44	0.92	0.49
C	Maximum	6.63	2.79	1.69	1.27	2.76	0.91	1.42	0.49
	Minimum	1.02	0.80	1.06	0.80	0.96	0.40	0.59	0.23
(N=6)	Average	2.84	1.42	1.25	0.99	1.48	0.50	1.05	0.40

TABLE 12 SAME AS TABLE 11 EXCEPT FOR NUMERICAL MODELS

Wind-Road Angle	Ratio of Predicted to Observed	DANARD	MROAD 2		RAGLAND		ROADS	
			Neutral	Unstable	Neutral	Unstable	Neutral	Unstable
A (N=6)	Maximum	1.72	1.86	0.98	2.55	1.63	4.56	1.94
	Minimum	0.83	0.77	0.39	1.13	0.27	1.91	0.80
	Average	1.27	1.25	0.65	1.78	1.17	3.16	1.35
B (N=7)	Maximum	1.57	1.57	0.78	3.39	2.98	3.96	1.62
	Minimum	0.70	0.63	0.31	1.30	1.29	1.59	0.65
	Average	1.16	1.10	0.55	2.22	2.03	2.79	1.14
C (N=5)	Maximum	2.05	1.94	0.75	3.52	2.61	5.32	2.97
	Minimum	1.10	0.91	0.35	1.62	1.41	2.37	1.12
	Average	1.32	1.21	0.53	2.53	2.15	3.12	1.53

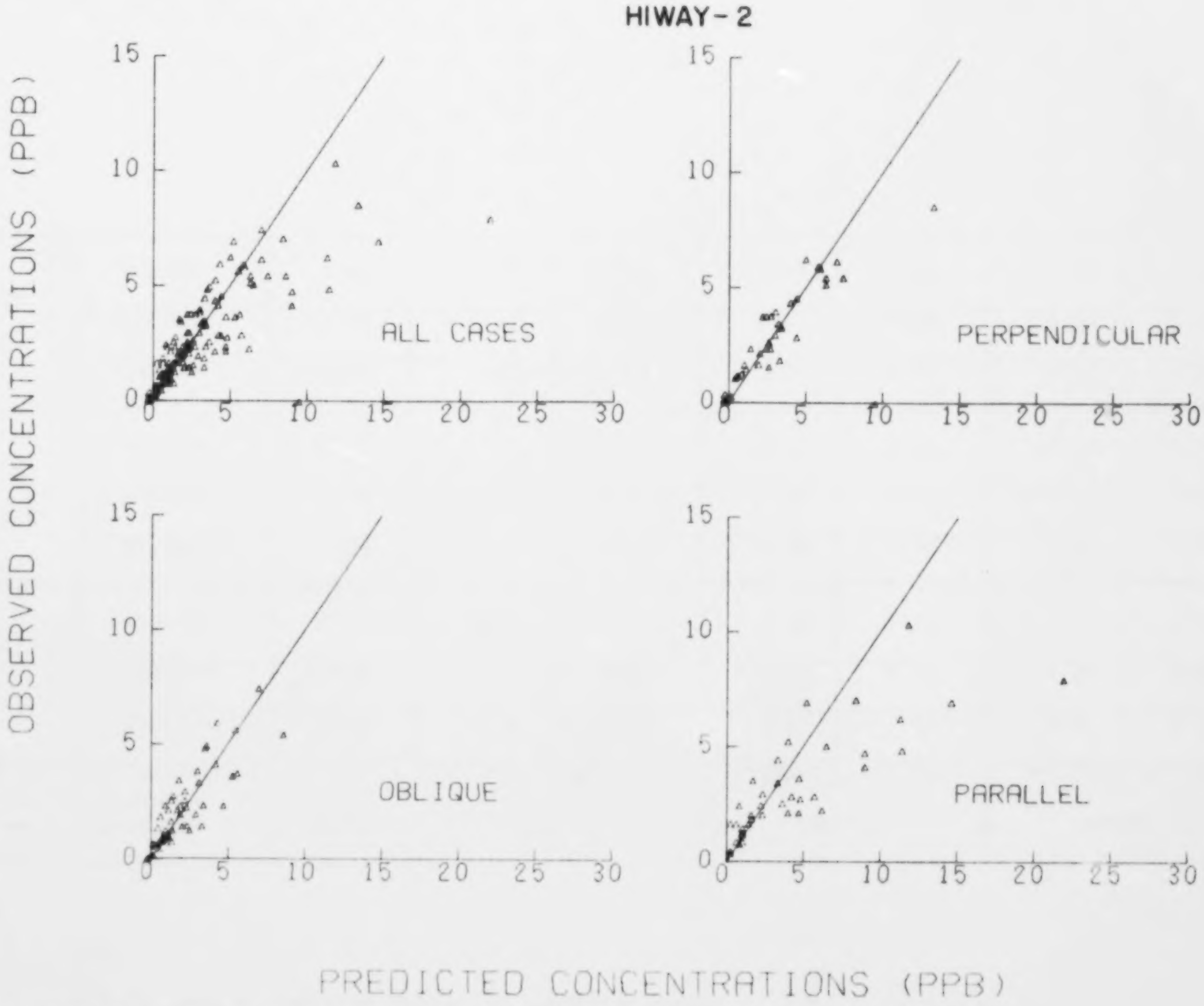


Figure 18a Scatter plot showing the HIWAY model predictions and observation. The 1:1 line is also drawn in the diagram. The points below the line indicate overprediction and above the line underprediction.

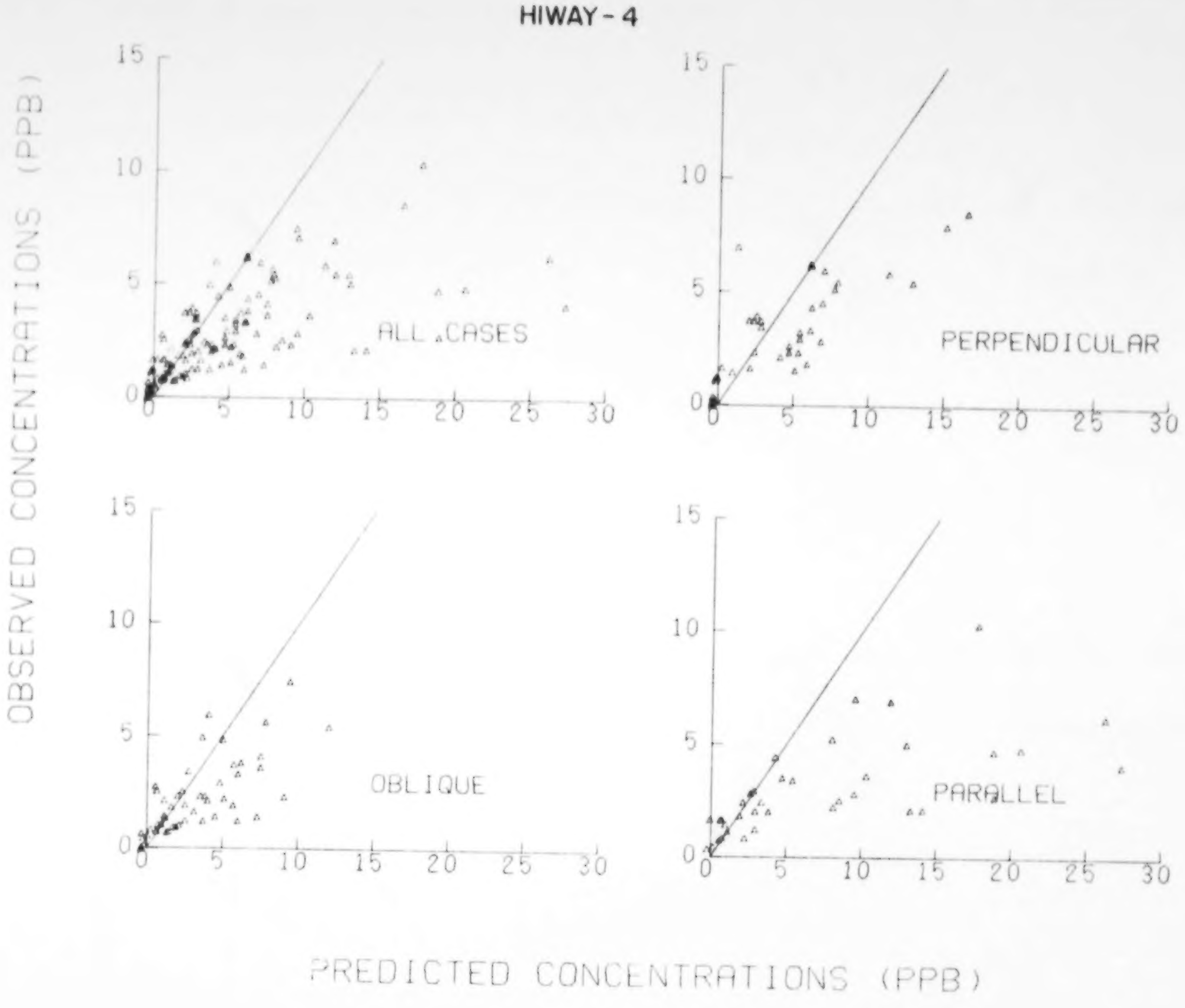


Figure 18b Scatter plot showing the HIWAY model predictions and observations. The 1:1 line is also drawn in the diagram. The points below the line indicate overprediction and above the line underprediction.

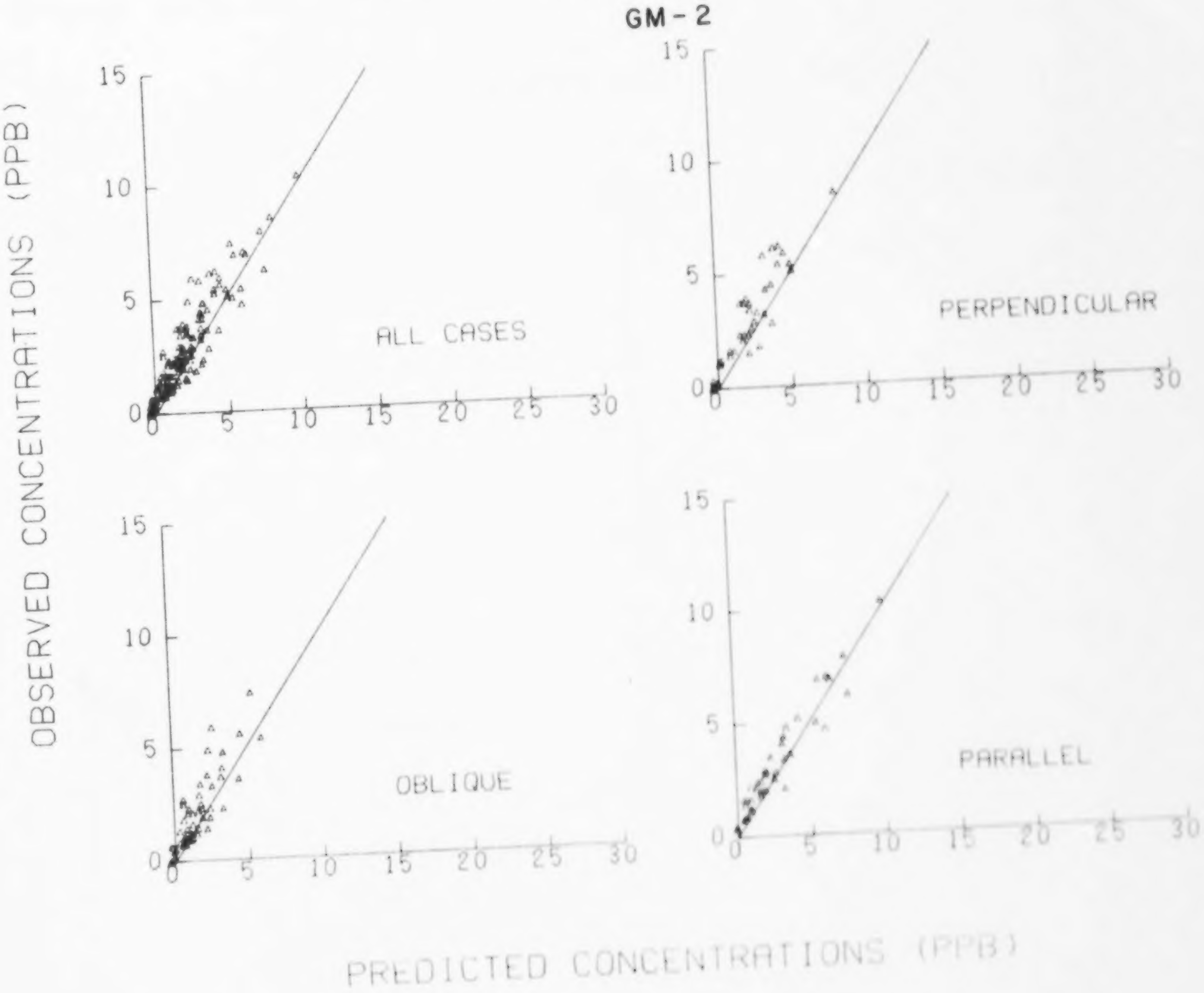


Figure 19a Same as Figure 18 except for GM model.

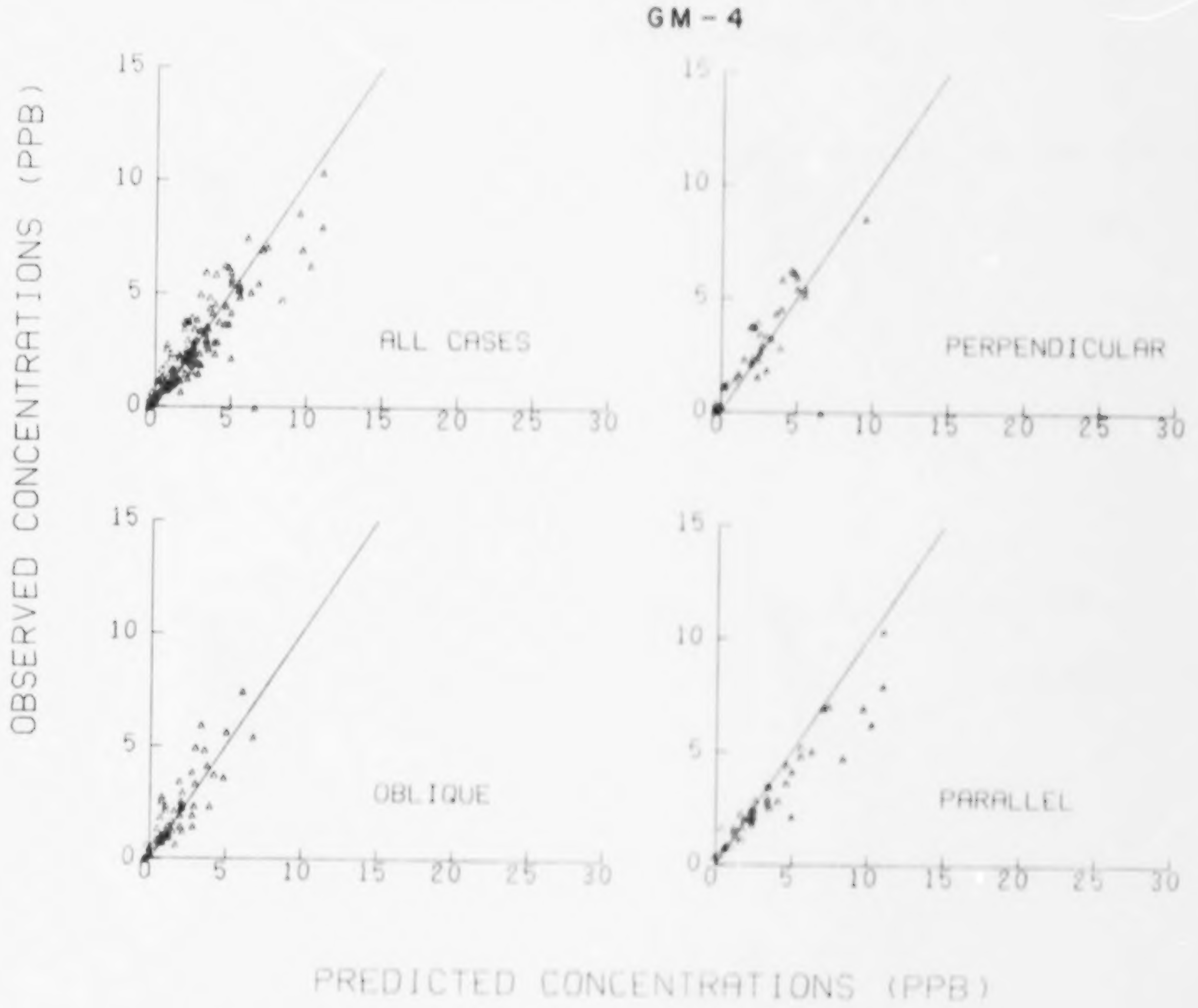


Figure 19b Same as Figure 18 except for GM model.

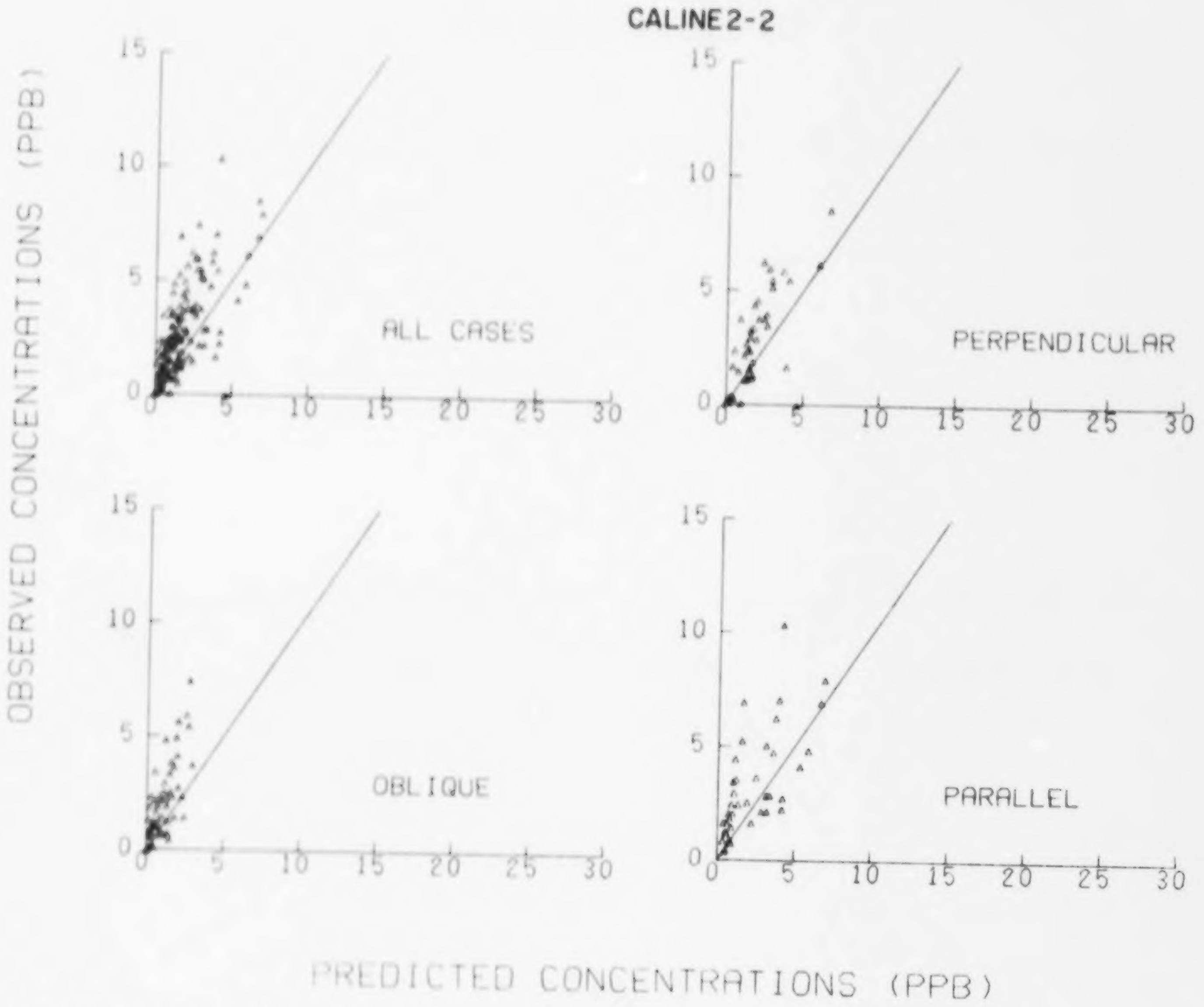


Figure 20a Same as Figure 18 except for CALINE-2 model.

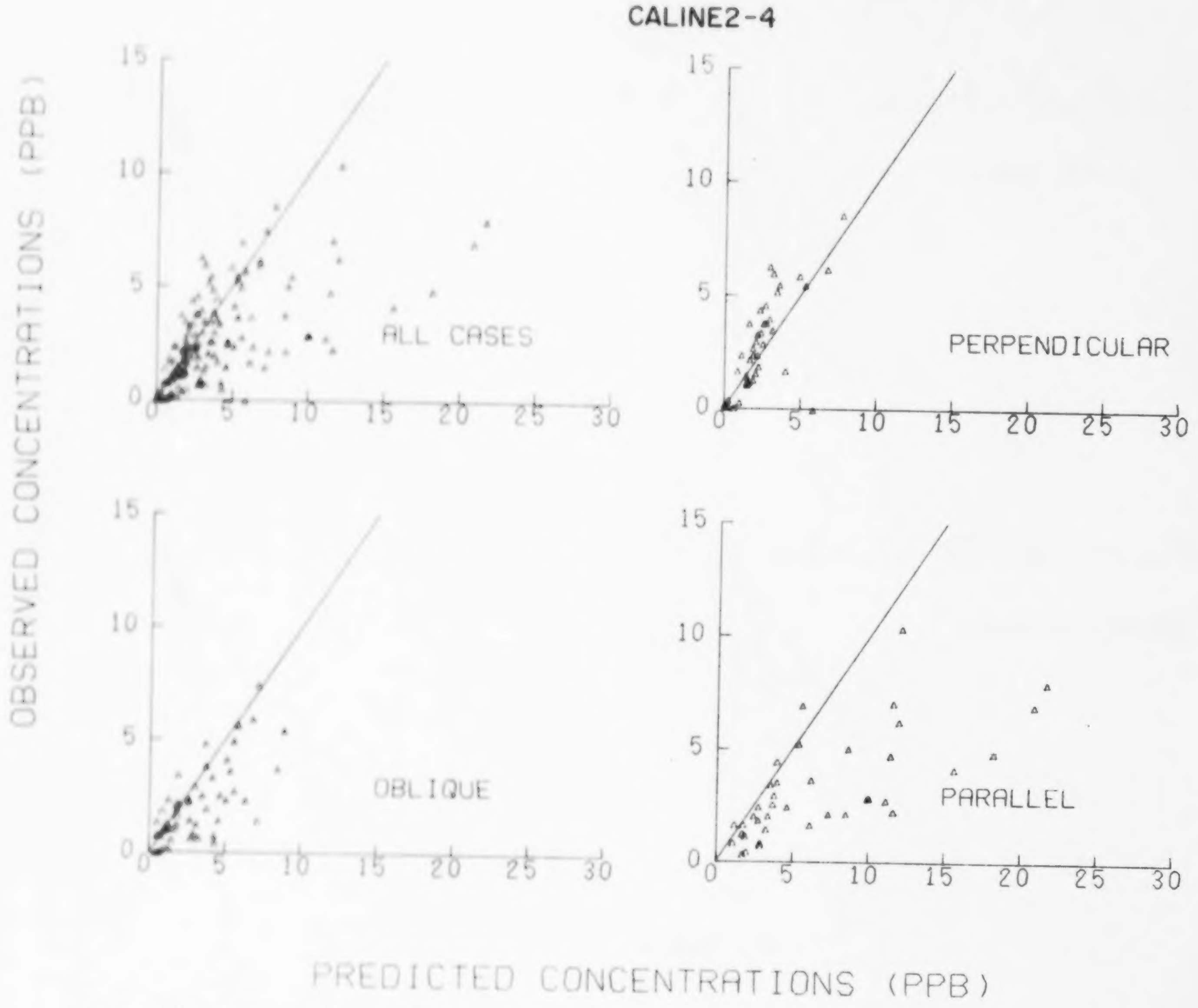


Figure 20b Same as Figure 18 except for CALINE-2 model.

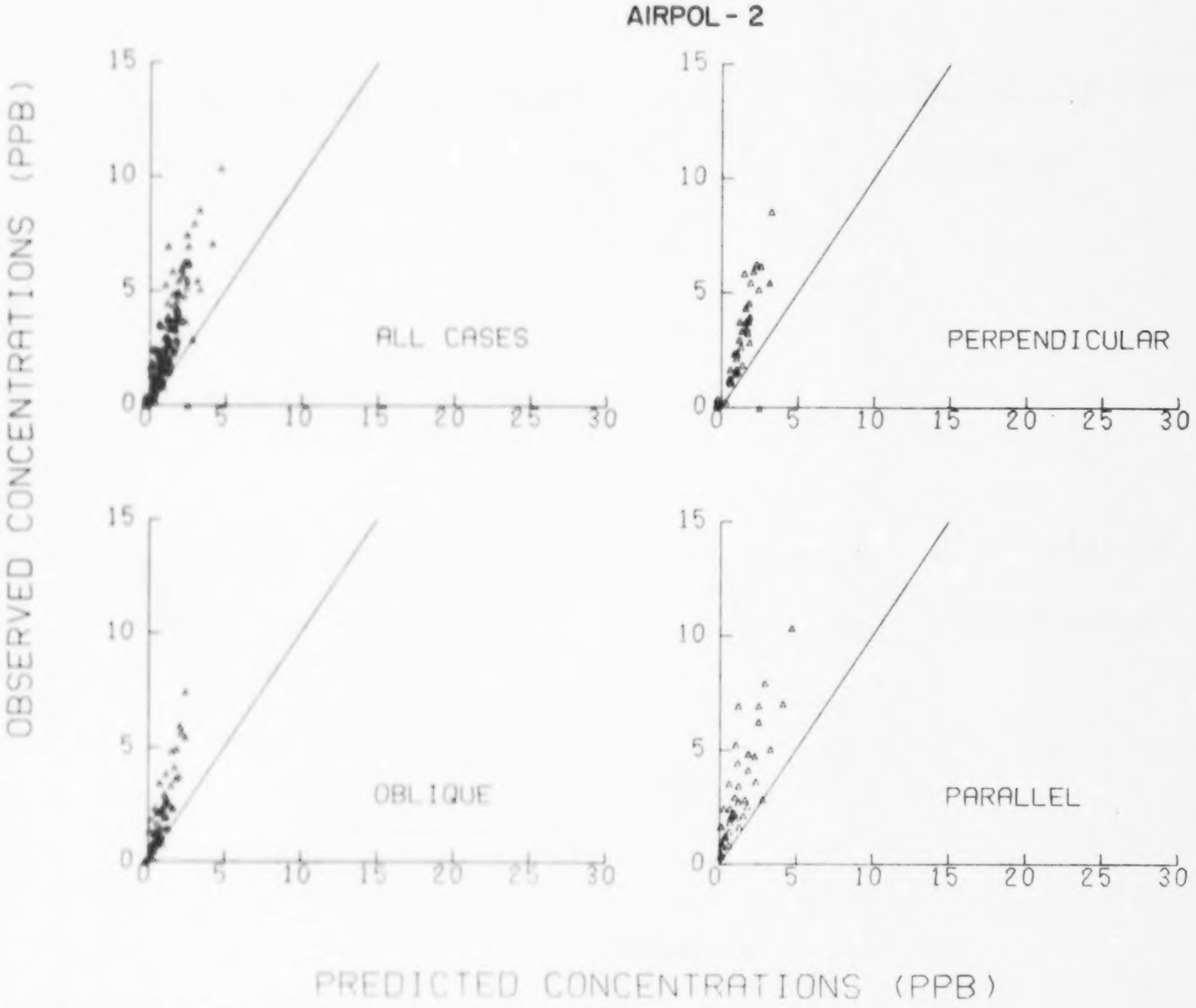


Figure 21a Same as Figure 18 except for AIRPOL model .

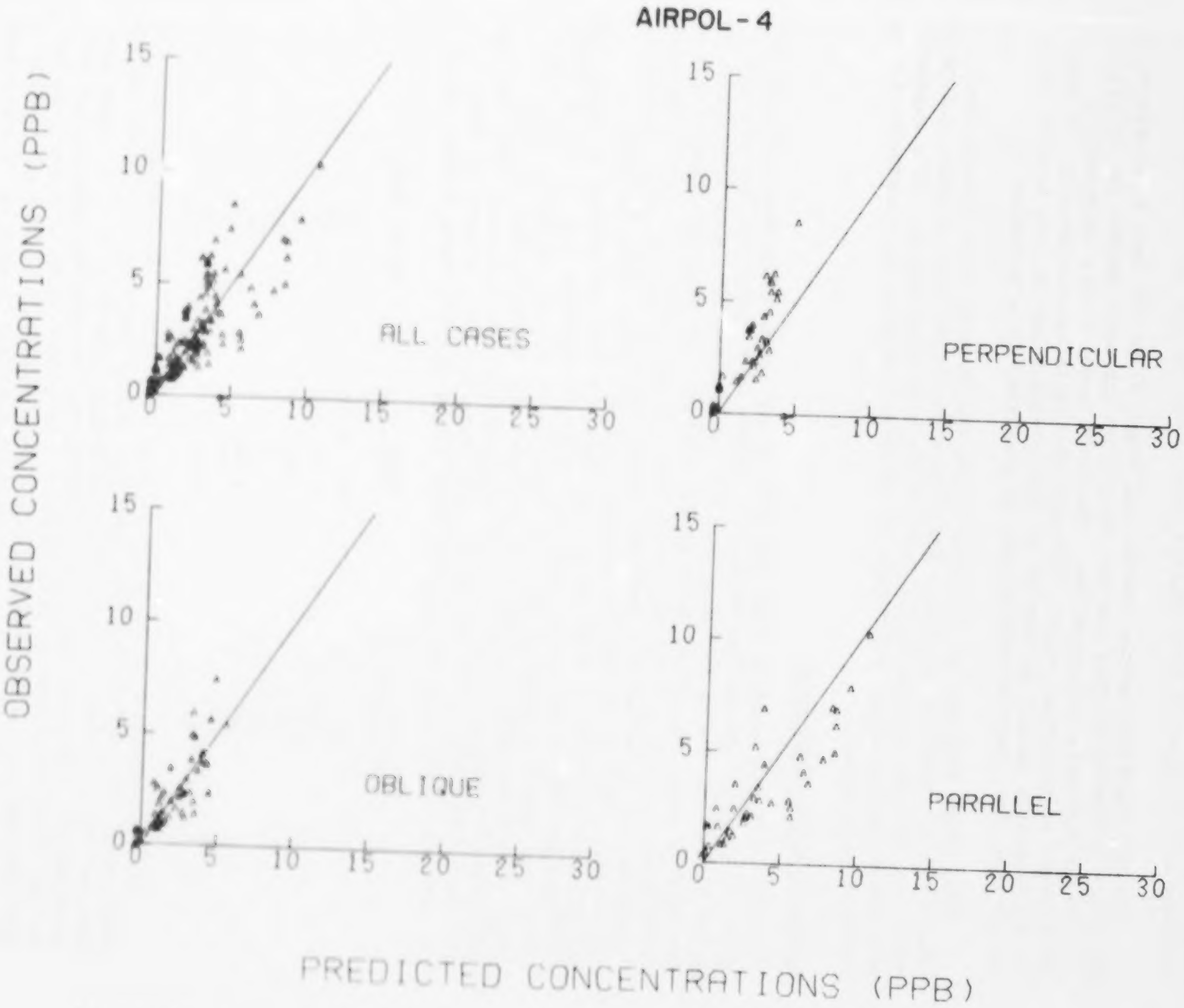


Figure 21b Same as Figure 18 except for AIRPOL model.

(Fig. 20b) only in the perpendicular case. The AIRPOL model has a greater tendency to underpredict than CALINE2 (Fig. 21a) for the less stable case.

All the numerical models tested (see Figs. 22 to 25) tend to overpredict. The major exception to this was the results of the model MROAD2 for stability 2 which consistently underpredicts. The ROADS model always overpredicts independent of wind-road angle. Although the explained variance in the case of the numerical models is similar to that of HIWAY and GM, the scatter plots reveal that the numerical models seem to consistently overpredict.

From these diagrams it is evident that the GM model provides the best simulation for this set of data. The simulation capability of HIWAY and GM is about the same for perpendicular and oblique wind-road angles. This suggests that HIWAY needs further refinement to properly describe the dispersion during parallel wind cases.

Carbon Monoxide (CO) Data

The wind measurements from location 7C and temperature data gathered for those hours which passed the CO editing checks were retrieved from the computer diskettes. Since the data from the traffic counters were unreliable for the profile sampling period, a synthetic traffic data base was created with a sufficient confidence based on on-site traffic film analysis. The CO data was segmented into 5 categories: weekday, Monday morning, Friday night, Saturday and Sunday. The hourly traffic volumes used are those shown in Table 1. Analysis of the traffic films indicated that the mean percentage of light duty vehicles was 90% (± 3%) with light duty trucks comprising 10% (± 2%) of these. Heavy duty gasoline powered vehicles were 65% (± 7%) of the heavy duty vehicles. Since the vehicle speeds are required for emission factors, the December 1976 traffic speeds as well as in-traffic measurements taken throughout the study period were reviewed. All hours for both directions were assigned to the average speed of 55 mph, except the following weekday hours:

Direction	Time	Speed (mph)
West	6 am - 8 am	30
West	9 am	50
East	2 pm	50
East	3 pm	30
East	4 pm	20
East	5 pm	25
East	6 pm	40

AP-42, Supplement 5, emission factors were used in conjunction with the HIWAY model and predictions were made for stabilities 2 and 4. Each sampling data set was adjusted by having the background removed from each measurement. Least-square regression analysis was performed between the model predictions and the background-removed measurements. If either value of a pair was zero, that pair was not used. Various data sub-sets were also examined, as well as comparison of normalized values. The normalization is done by dividing each measured value by the maximum concentration measured for that hour.

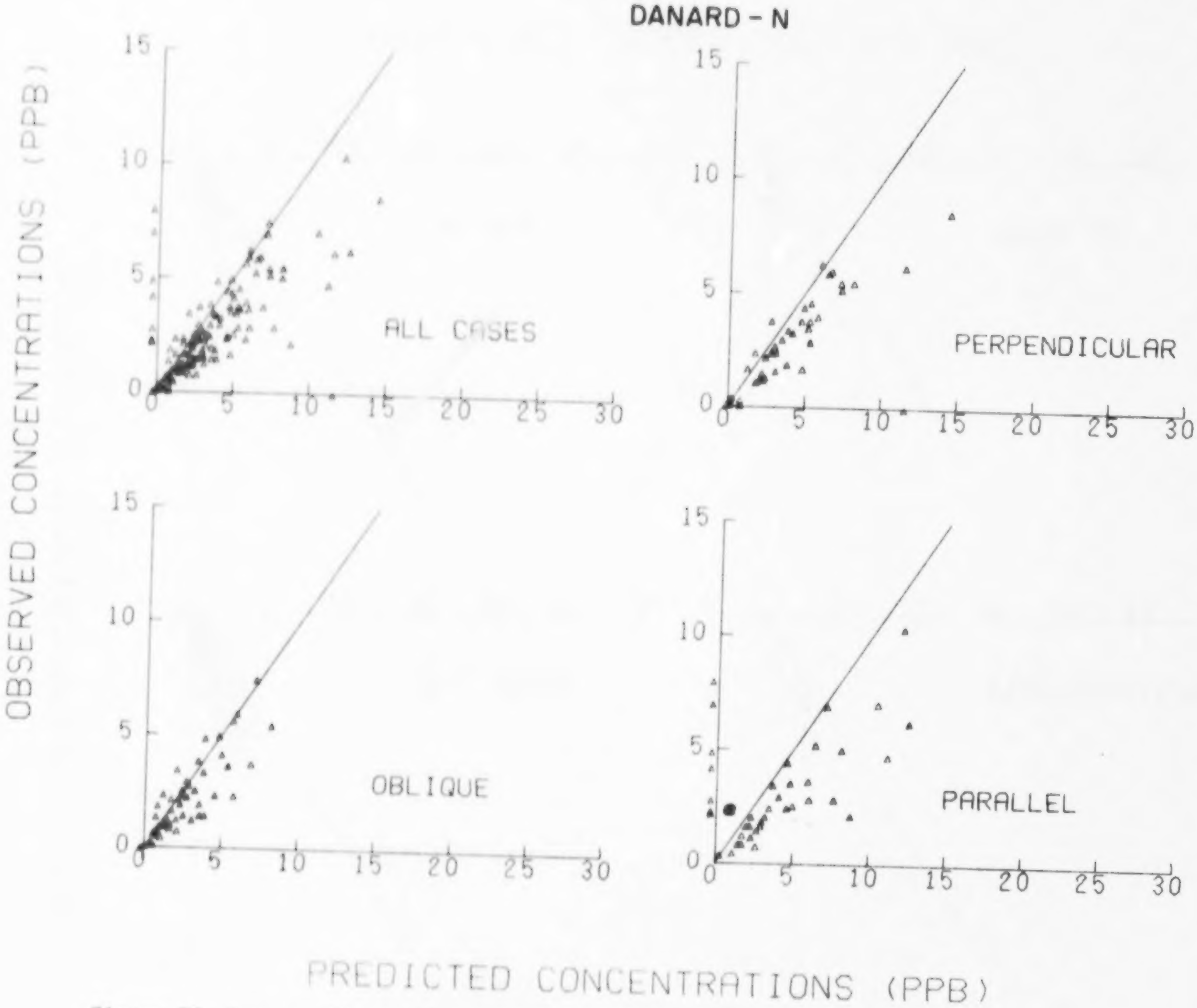


Figure 22 Same as Figure 18 except for DANARD model.

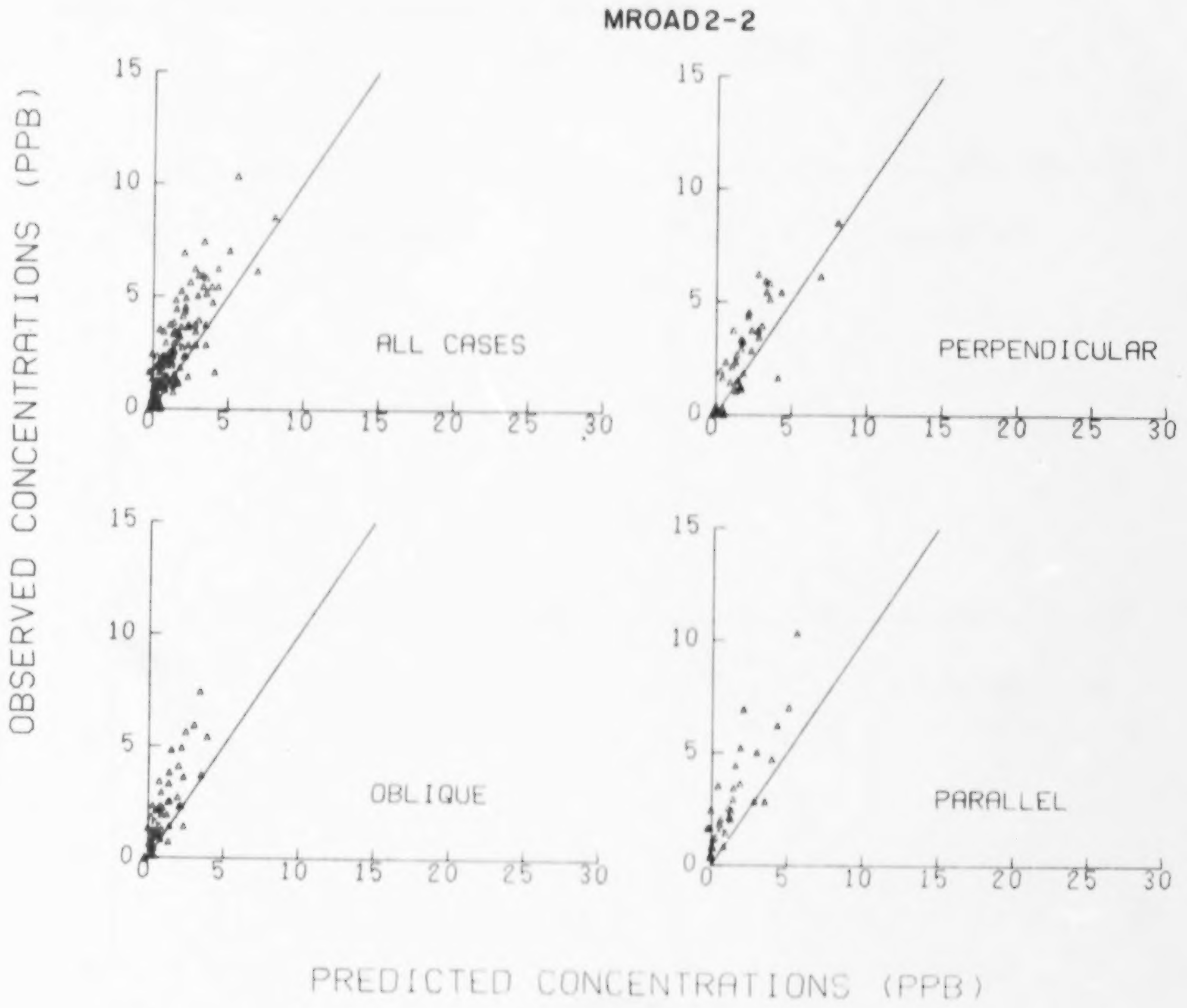


Figure 23a Same as Figure 18 except for MROAD2 model.

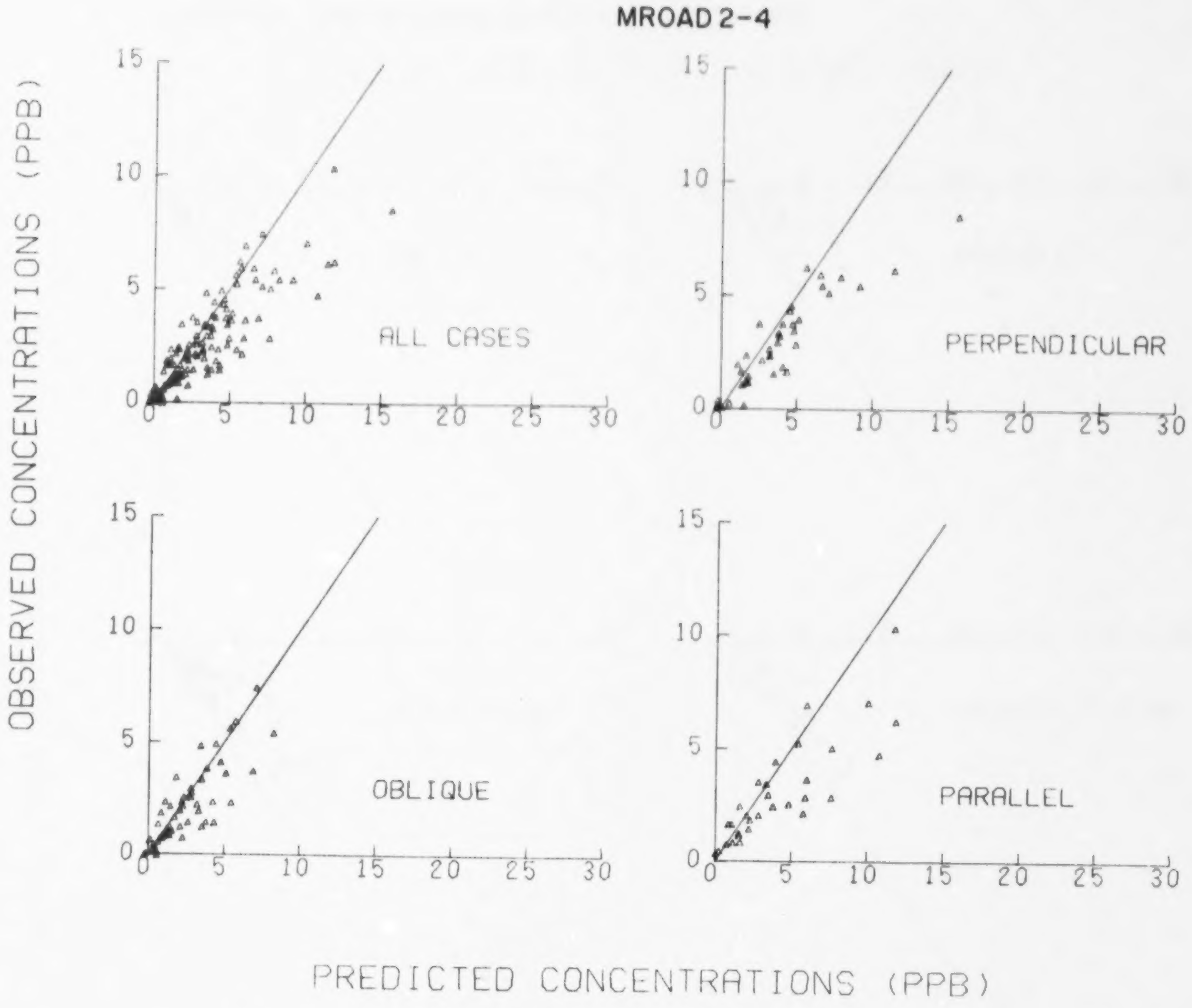


Figure 23b Same as Figure 18 except for MROAD2 model.

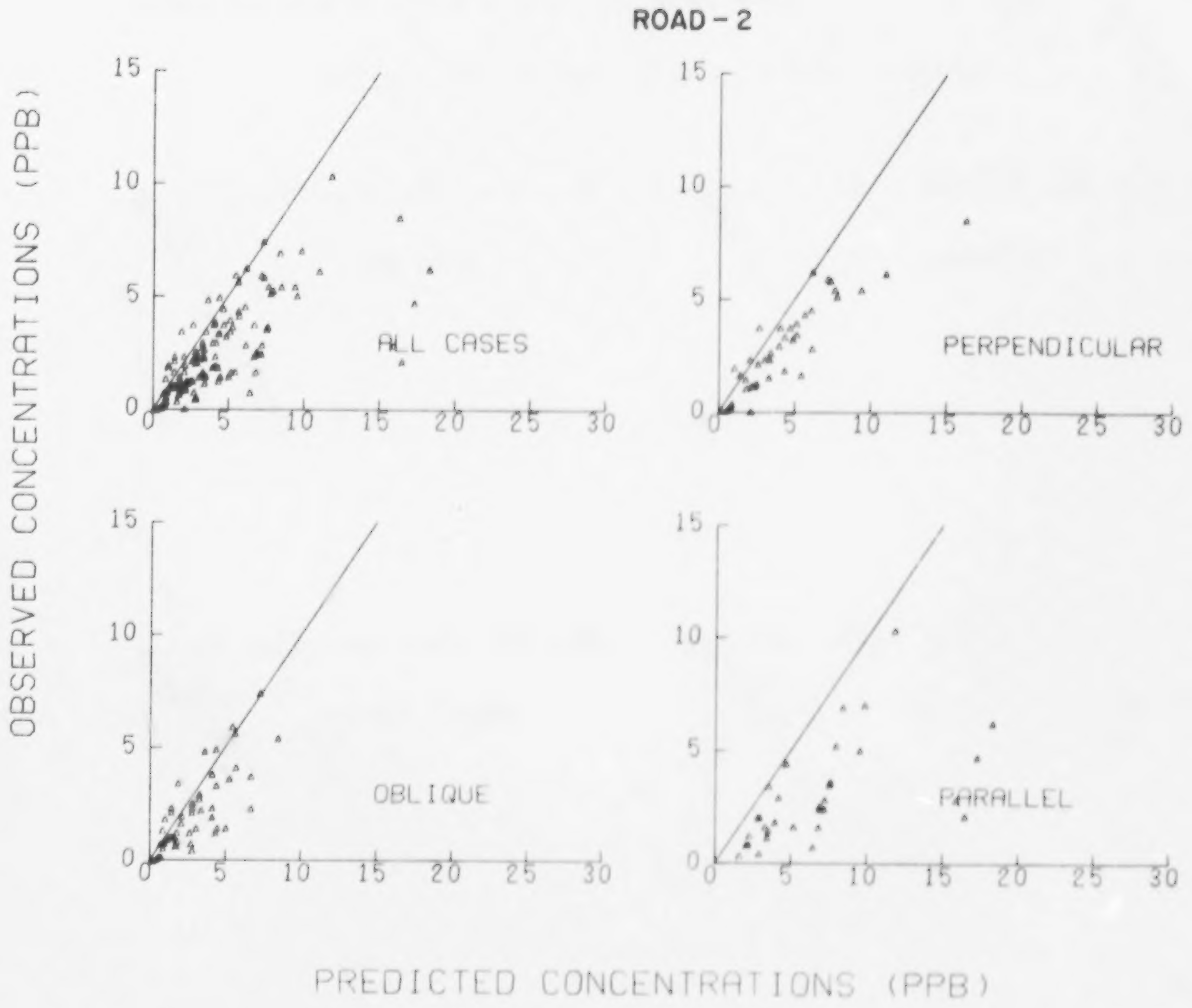


Figure 24a Same as Figure 18 except for ROADS model.

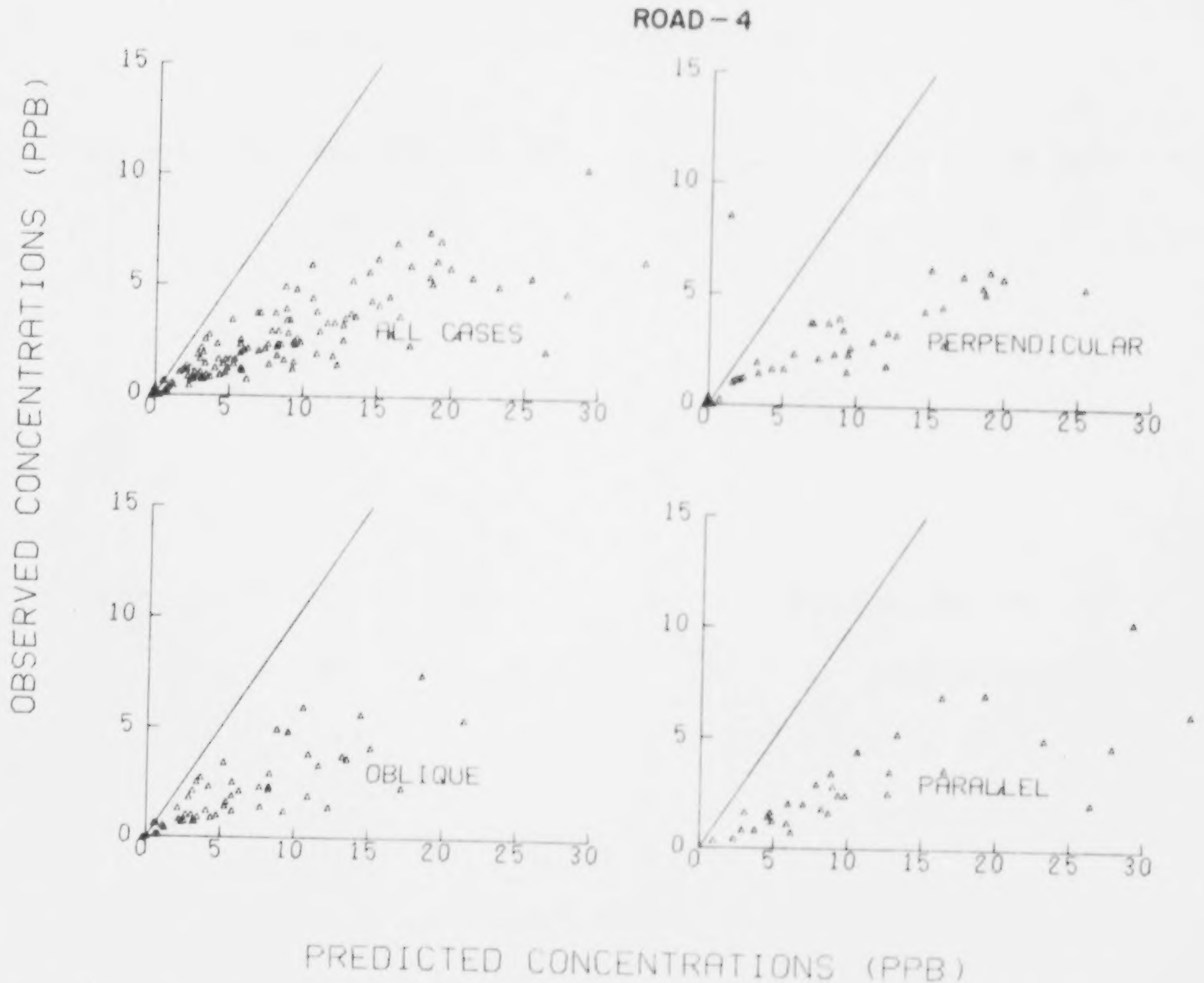


Figure 24b Same as Figure 18 except for ROADS model.

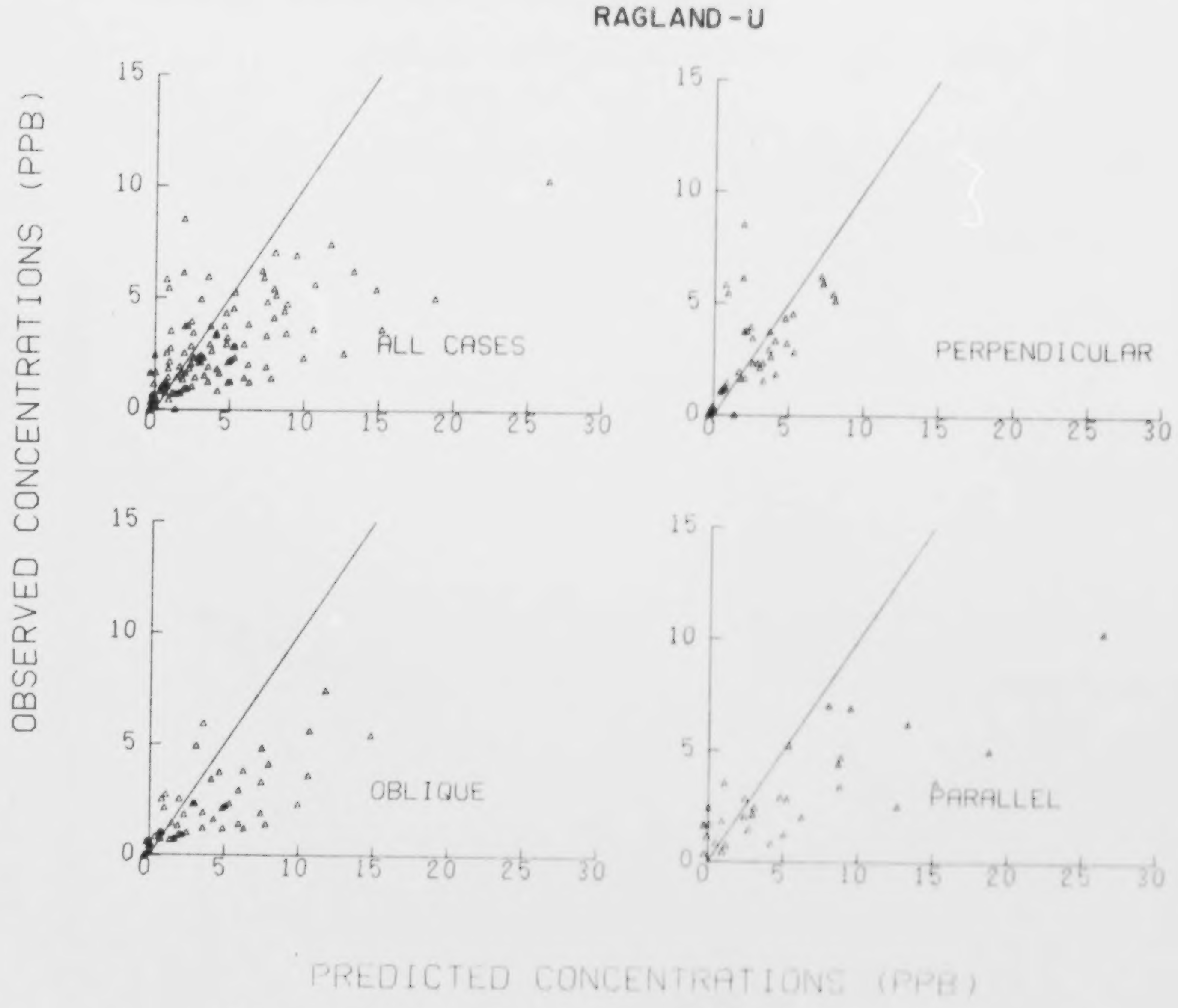


Figure 25a Same as Figure 18 except for RAGLAND model.

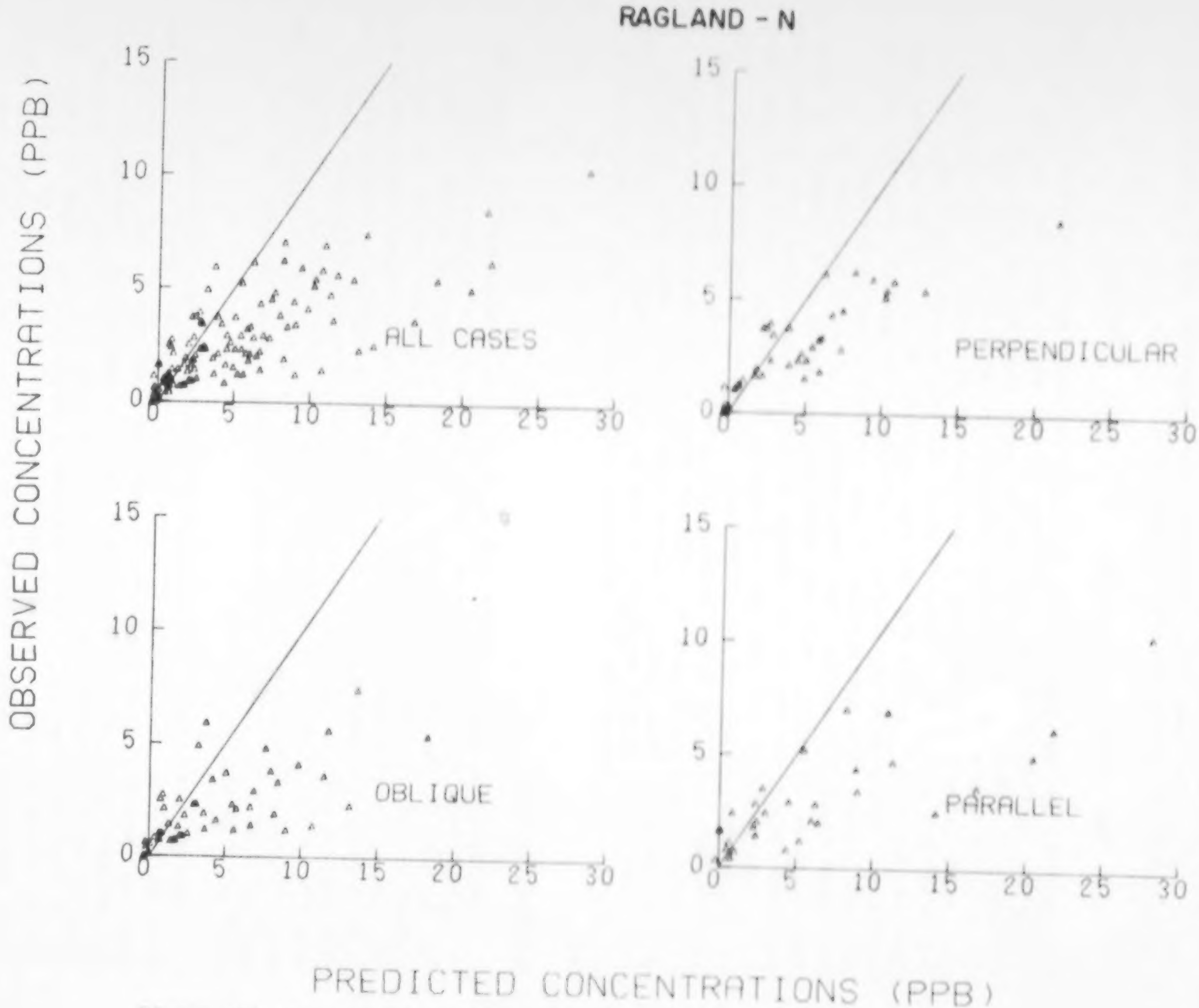


Figure 25b Same as Figure 18 except for RAGLAND model.

Table 13 presents the results of regression analysis for both stabilities 2 and 4. For comparison purposes, the regression statistics for the CO data collected during the tracer study are:

$$OBS = 0.77 + 0.53 \times PRE., \quad r^2 = 0.30, \quad N = 101.$$

Thus, much of the decrease in the explained variance may be attributed to the uncertainty introduced in the estimation of the actual emission, as well as inaccuracy in sample analysis. As can be seen, the results with stability 2 have a better correlation and slope compared to those with stability 4. The model predictions with stability 2 were further examined for the effects of wind speed and direction. Table 14 lists the regression statistics. It is observed that only the runs for the wind speed group of 2 to 5m/sec show any significant change from the overall statistics. In general, for wind speeds less than 2m/sec, the correlation is poor and the slope is too low. In the wind speed range 2 to 5m/sec, the correlation is greatly improved and the slope is close to unity. When the data are segregated as a function of wind-road orientation, we see little change in the computed regression coefficients. It is interesting to see that the regression coefficients for normalized data are significantly high and are independent of the wind-road orientation. This suggests that the HIWAY model handles the physics of the dispersion problem quite well. This would seem to indicate that if the dispersion parameters used in the model were chosen properly such that they represent the atmospheric conditions near a highway, it can be expected that the model would be capable of reproducing the air pollution concentrations near highways quite well.

Particulate Data

Two Gaussian models, HIWAY and GM, were used to simulate the dispersion of particulates from the highways. Table 15 lists the various emission factors used in the emission program. The total number of trucks on the highway was at most 13% of the total traffic. The split between the heavy duty gasoline and heavy duty diesel trucks was 2 to 1 respectively, while the light duty trucks comprised 10% of the light duty traffic. Vehicle registration data as well as the films and visual traffic counts indicated that at most 30% of the light duty vehicles were 1975 or later models. Therefore, conservatively 30% of the light duty vehicle population had catalyst equipped engines. Table 16 summarizes the above vehicle population used for the emission programs.

The above two dispersion models were run utilizing the meteorological data obtained at a height of 8m on the median tower 7. Since the particulate data base was collected for various sampling durations (1 1/2 to 2 1/2 hours), the meteorological data were averaged over the appropriate sampling interval. From the observed meteorological data at the site and at the Islip airport (about 25km from the site), the atmospheric stability was found to range from neutral (Pasquill-Turner classification of the airport data) to unstable (bulk Richardson number estimates using the on-site data). Hence, the HIWAY model was run for neutral stability (HW 4), and unstable stability (HW 2), for all the available data. On the other hand, the GM model was run only for

TABLE 13 REGRESSION STATISTICS FOR HIWAY MODEL PREDICTIONS WITH STABILITIES 2 AND 4, AND MEASUREMENTS OF CO

Stability	Type	Height (m)	r^2	a	b	N
2	Data	2	0.23	1.14	0.32	704
2	Data	2 to 16	0.26	0.92	0.36	1040
2	Normalized	2	0.58	0.18	0.75	716
2	Normalized	2 to 16	0.67	0.14	0.78	1110
4	Data	2	0.19	0.15	0.19	749
4	Data	2 to 16	0.20	0.05	0.19	1012
4	Normalized	2	0.47	0.20	0.68	758
4	Normalized	2 to 16	0.53	0.23	0.65	1071

TABLE 14 EFFECT OF WIND SPEED AND DIRECTION ON HIWAY MODEL CO PREDICTIONS USING STABILITY 2. THIS TABLE PRESENTS THE REGRESSION STATISTICS

Direction	r^2	a	b	N
Perpendicular	0.29	0.93	0.45	391
Oblique	0.27	1.00	0.33	287
Parallel	0.26	0.79	0.33	362

Wind Speed (m/sec)	r^2	a	b	N
less than 2	0.29	0.97	0.27	386
2 to 5	0.42	0.47	0.90	560
greater than 5	0.36	0.34	1.39	94

2 to 5m/sec Winds	r^2	a	b	N
Perpendicular	0.49	0.33	1.29	174
Oblique	0.38	0.56	0.98	156
Parallel	0.53	0.31	0.81	230

	Emission Factor (g/mi)	Vehicle Type
Lead	0.06	LDV[1], LDT[1], & HDG
Particulates	0.54	LDV & LDT
	1.21	HDG
	1.61	HDD
Sulfate	0.003	LDV[2], LDT[2]

1 - non-catalyst vehicles only

2 - catalyst vehicles only

TABLE 15 EMISSION FACTORS USED IN THE PARTICULATE MODEL EVALUATION

Vehicle Type	Percent of Total Traffic
LDV (Non Catalyst)	54.8
LDV (Catalyst)	23.5
LDT (Non Catalyst)	6.1
LDT (Catalyst)	2.6
HDG	8.7
HDD	4.3

TABLE 16 BREAKDOWN OF THE VEHICLE POPULATION USED IN THE EMISSION PROGRAM FOR PARTICULATE MODELING

neutral stability since there was little difference between the predictions for neutral and unstable cases.

The comparison between the observed and predicted concentration of sulfate, lead and particulates for the two models is presented in Table 17. It is evident from the table that there is no significant correlation between the model predictions and the measurements except for lead. Further analysis was carried out to study the dependence of the lead predictions on the wind speed and wind-road orientation angle. Again, the data were divided into three sub-sets, namely, cases with wind speed less than 2m/sec, 2 to 5m/sec, and greater than 5m/sec. The model predictions and measurements are compared and the results summarized in Table 18. It can be seen that the HIWAY model's predictive capability improves with increasing wind speed. For low wind speeds, the GM model performed better than HIWAY. Next, the models were run segregating the lead data by wind-road orientation angle and the regression statistics are presented in Table 19. In general, as the orientation angle increases (as the wind becomes more perpendicular to the highway), the predictions improve.

In order to establish the applicability of the dispersion parameters used in the two models, data from each run were normalized by observed maximum concentration for that run and compared to the normalized concentrations predicted by the models. Normalization removes the models' dependence on wind speed and emissions and allows a direct comparison of the concentration profiles. Table 20 lists the results of this analysis, which show that the dispersion mechanism is treated somewhat better by the HIWAY model using unstable stability than the GM model.

The model comparisons are summarized in cumulative frequency distributions of observed and predicted concentrations of lead at receptor location 9A in Figure 26. It is evident from this plot that HIWAY using neutral stability overpredicts lead levels 50% of the time, while for unstable stability the overprediction is reduced to 20% of the time. On the other hand, the GM model appears to predict the concentrations at the nearest roadside receptor. However, comparisons of cumulative plots for 9B (not shown here) indicate that both models overpredict approximately 30% of the time. Although the agreement between the cumulative distributions of observed and the GM predictions appear to be good, it should be borne in mind that there need not be a one-to-one correspondence between a predicted and the corresponding measured value in Figure 26. This is reflected in the results of the regression analysis for the set of observations from which the cumulative plots were developed (N = 84, $r^2 = 0.14$, slope = 0.35, intercept = 2.3, and Student's T value = 3.6).

The lack of significant correlations between the predicted and measured concentrations for these pollutants could, in general, be due to the difference in the transport characteristics between gaseous and particulate matter. Also, the dispersion models assume quasi-steady wind and traffic conditions, which are not satisfied over the entire sampling period. In the case of particulates the observed data is from the fine particle filters only, which corresponds to particles less than 3.5 μm, while the model predictions

TABLE 17 COMPARISON OF HIWAY AND GM MODEL PREDICTIONS WITH THE OBSERVED PARTICULATE DATA. THE CRITICAL r^2 FOR 400 DATA POINTS AT THE 1% LEVEL IS 0.032 AND THE STUDENT'S T VALUE FROM THE STATISTICAL TABLES AT 1% LEVEL IS 2.6

Pollutant	Model	Explained Variance r^2	Standard Error of Estimate	Intercept	Slope	Computed T Value	Number of Data Points
Sulfate	GM	0.044	2.4	1.36	17.61	4.4	430
	HW2	0.024	2.4	1.70	8.21	3.2	
	HW4	0.018	2.4	1.81	3.84	2.8	
Particulate	GM	0.093	14.0	11.72	0.19	7.0	480
	HW2	0.112	13.8	12.83	0.14	7.7	
	HW4	0.068	14.2	14.69	0.06	5.9	
Lead	GM	0.38	1.2	0.81	0.64	17.7	509
	HW2	0.33	1.3	1.22	0.39	15.8	
	HW4	0.22	1.4	1.54	0.18	11.9	

TABLE 18 REGRESSION STATISTICS FOR LEAD AS A FUNCTION OF WIND-ROAD ORIENTATION ANGLE. THE CRITICAL r^2 FOR 100 POINTS AT THE 1% LEVEL IS 0.07 AND THE STUDENT'S T VALUE AT THE 1% LEVEL IS 2.6

Wind Speed (m/sec.)	Model	Explained Variance r^2	Standard Error of Estimate	Intercept	Slope	Computed T Value	Number of Data Points
< 2	GM	0.35	1.5	0.48	0.67	7.3	100
	HW2	0.31	1.6	1.05	0.35	6.6	
	HW4	0.12	1.8	2.10	0.11	3.6	
2-5	GM	0.26	1.2	1.05	0.60	9.9	279
	HW2	0.34	1.2	0.80	0.72	11.9	
	HW4	0.21	1.3	1.40	0.28	8.6	
> 5	GM	0.48	0.8	0.18	1.03	10.9	130
	HW2	0.65	0.6	-0.49	1.78	15.4	
	HW4	0.46	0.8	0.11	0.84	10.4	

TABLE 19 REGRESSION STATISTICS FOR LEAD AS A FUNCTION OF WIND-ROAD ORIENTATION ANGLE. THE CRITICAL r^2 FOR 80 DATA POINTS AT THE 1% LEVEL IS 0.08 AND THE STUDENT'S T VALUE AT THE 1% LEVEL IS 2.6

Wind Angle (Deg)	Model	Explained Variance r^2	Standard Error of Estimate	Intercept	Slope	Computed T Values	Number of Data Points
< 30	GM	0.27	1.4	0.97	0.47	7.5	157
	HW2	0.26	1.4	1.45	0.28	7.3	
	HW4	0.21	1.4	1.60	0.13	6.5	
30-60	GM	0.50	1.1	0.49	0.88	16.3	266
	HW2	0.40	1.2	0.92	0.56	13.4	
	HW4	0.32	1.2	1.12	0.34	11.1	
> 60	GM	0.52	1.1	0.64	0.79	9.5	86
	HW2	0.47	1.2	1.05	0.51	8.6	
	HW4	0.34	1.4	1.32	0.31	6.5	

Model	Explained Variance r^2	Standard Error of Estimate	Intercept	Slope	Computed T Value	Number of Data Points
GM	0.52	0.21	-0.05	0.93	23.5	509
HW2	0.62	0.19	-0.12	1.04	28.8	
HW4	0.40	0.24	0.10	0.69	18.6	

TABLE 20 REGRESSION STATISTICS FOR LEAD BETWEEN NORMALIZED MODEL PREDICTIONS AND MEASUREMENTS. THE CRITICAL r^2 FOR 500 DATA POINTS AT THE 1% LEVEL IS 0.013 AND THE CORRESPONDING T VALUE IS 2.6

Height (m)	Model	Explained Variance r^2	Standard Error of Estimate	Intercept	Slope	Computed T Value	Number of Data Points
2	GM	0.43	1.3	0.82	0.71	15.4	320
	HW2	0.33	1.4	1.49	0.38	12.4	
	HW4	0.19	1.5	1.82	0.16	8.7	
5	GM	0.19	1.0	0.97	0.36	6.7	189
	HW2	0.25	1.0	0.97	0.32	7.9	
	HW4	0.14	1.1	1.27	0.14	5.4	

TABLE 21 REGRESSION STATISTICS FOR LEAD FOR TWO RECEPTORS AT DIFFERENT HEIGHTS. THE CRITICAL r^2 FOR 180 DATA POINTS AT THE 1% LEVEL IS 0.04 AND THE T VALUE AT 1% LEVEL IS 2.6

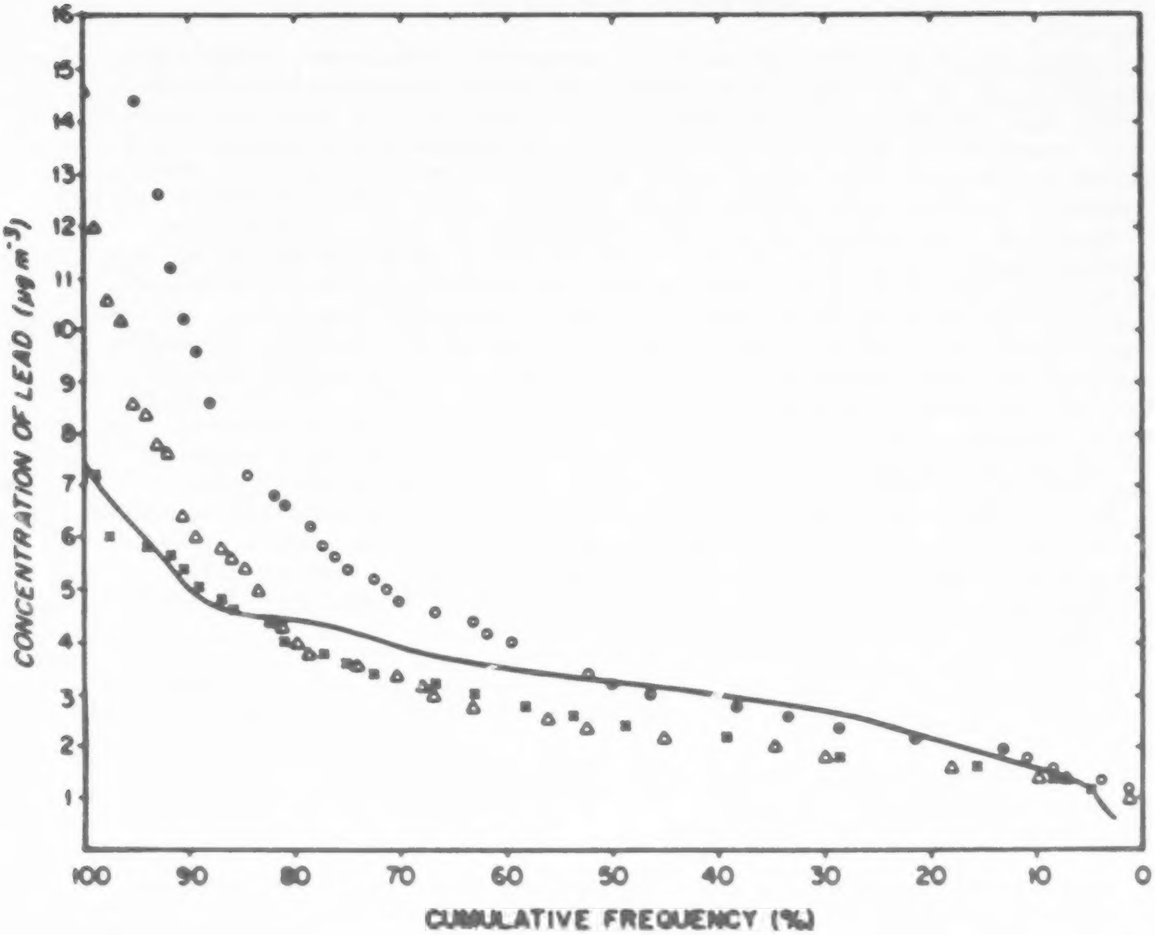


Figure 26 Cumulative frequency distributions for lead at 9A. Solid line is for the observed data, x's denote GM model predictions, Δ's denote HIWAY stability 2 predictions, and o's denote HIWAY neutral predictions. The total number of data points is 84.

are formulated for the total particulates. Bradway et al (1978) reported that 23% to 32% of hi-vol total particulates by mass are collected on the fine filter of a dichotomous sampler, depending on the height of sampling. Hence, this would result in the model overprediction as observed in Table 17. The regressions between measured and predicted for lead at the two receptor heights are presented in Table 21. It can be seen that both models behave better at the 2m height, with a marked reduction in the explained variance and slope for the GM model at the 5m level. Therefore, the sigma values used in the models should be reevaluated.

DISPERSION PARAMETERS

In the Gaussian diffusion models, atmospheric turbulence, topographic features, wind speed, sampling interval, and other meteorological variables are all represented by the two parameters, σ_y and σ_z. The existing Gaussian models prescribe σ_y and σ_z as functions of the atmospheric stability which is arbitrarily divided into six or seven stability classes in terms of readily observable features like surface wind, incoming solar radiation and/or degree of cloudiness, all assumed to be in-variant over an hour. Diffusion in numerical models is parameterized by use of eddy diffusivity values K_x, K_y, and K_z along the three axes, representing the diffusivity in the downwind, crosswind and vertical directions. The many conditions that govern the fate of pollutant emissions like the micrometeorology of the terrain, the modification of the eddy diffusivity coefficients due to a heat-island effect, etc., can be taken into account in these numerical models. These complex models, however, require the specification of a great deal of detailed information on the eddy diffusivity and wind profiles and their behavior under different atmospheric stability conditions. Such detailed data is presently nowhere available. Therefore, the various eddy diffusivity values for different stabilities have been assumed without factual basis. The magnitudes of these parameters vary from model to model. Consequently, choosing values which are physically realistic would be expected to improve the simulation capability of the model.

The diffusivity values used in each of the numerical models tested are compared in Table 22, for neutral atmospheric stability and roughness length of 1m. It should be noted that Danard's values are consistently higher than either of the other three models, with a difference of close to two orders of magnitude over the roadway. Also, none of these models deal with the vehicle-induced turbulence near the highway.

The dispersion values in the Gaussian models, on the other hand, are essentially the standard deviations of the plume spread along the cross wind direction (σ_y) and vertical direction (σ_z). The values for these parameters are specified as a function of atmospheric stability and downwind distance from the source. Since the source strength in the tracer gas experiments is known, and measurements of concentrations at various receptors and meteorological conditions during the experiment are available, the vertical diffusion coefficient can be computed from the line source equation:

Model	Height (m)	K_z (m^2 sec^{-1})		K_y (m^2 sec^{-1})	
		Min	Max	Min	Max
RAGLAND	2	0.05	0.31	0.03	0.16
	10	0.27	1.56	0.14	0.78
	16	0.43	2.50	0.22	1.25
DANARD	2	0.42	20.00	0.42	20.00
	10	0.63	5.21	0.63	5.21
	16	3.00	9.00	3.00	9.00
MROAD 2	2	0.07	0.55		
	10	0.50	4.18		
	16	0.86	7.13		
ROADS	2	0.06	0.54	0.06	0.54
	10	0.32	2.70	0.32	2.70
	16	0.52	4.32	0.52	4.32

TABLE 22 RANGE OF DIFFUSIVITIES USED BY THE FOUR NUMERICAL MODELS TESTED IN THIS STUDY FOR NEUTRAL STABILITY CONDITIONS WITH A SURFACE ROUGHNESS OF 1m. NOTE DANARD'S K_y IS ACTUALLY CROSS-ROAD DIFFUSIVITY WHILE THE VALUES GIVEN FOR RAGLAND ARE CROSS-WIND. THE CROSS-WIND DIFFUSIVITY FOR MROAD2 IS NOT SPECIFIED IN THE LITERATURE.

$$C = \sqrt{\frac{2}{\pi}} \frac{Q}{\bar{u} \sin \theta \sigma_z} \exp \left(-\frac{1}{2} \frac{z^2}{\sigma_z^2} \right)$$

where C is the observed concentration, $\bar{u}$ is the mean wind speed, θ is the angle between wind direction and the orientation of the road, z is the height of receptor, and σ_z is the vertical diffusion parameter. At each tower location, since σ_z is not a function of height and the wind is uniform in the layer (Gaussian assumptions), σ_z is evaluated from the relation

$$\sigma_z^2 = \frac{z_2^2 - z_1^2}{2 \ln \frac{C_1}{C_2}}$$

where z_2 and z_1 are two levels at which C_2 and C_1 are the observed concentrations. Again, σ_z as a function of downwind distance (x) is evaluated through the relation

$$\frac{C \text{ (at } X_1)}{C \text{ (at } X_2)} = \frac{\sigma_{z,x_2}}{\sigma_{z,x_1}} \exp \left[\frac{-z}{2 \sigma_{z,x_1}^2 \sigma_{z,x}^2} \left(\sigma_{z,x_1}^2 - \sigma_{z,x_2}^2 \right) \right]$$

since we know the values of σ_z at x_1 and the other variables. Also σ_z values are obtained from the GM model using the formulation (Chock, 1977).

$$\sigma_z = \left[a + bx\, f(\theta) \right]^c$$

$$f(\theta) = 1 + \beta \left| \frac{\theta - 90}{90} \right|^r$$

Where a, b, c, β and r are the empirical constants, θ the wind-road angle and x the downwind distance.

Figure 27 is a plot comparing the σ_z values from the GM model to the computed values. It is evident from this diagram that the agreement between the GM values and the computed values is quite good for $\theta \geq 30^\circ$. For $\theta < 30^\circ$ (parallel winds) the GM values are consistently higher than the computed values. This is due to the fact that, in parallel wind cases, distance from the median was used as the downwind distance x, rather than the effective downwind distance. The computed values for the perpendicular wind-road orientation ($60^\circ \leq \theta \leq 90^\circ$) are compared to those specified in the HIWAY model under stability 2 (unstable) in Fig. 28. It should be mentioned that most of the tracer experiments periods were under neutral stability as per Pasquill-Turner classification, while from Fig. 28 and from Table 3 it is clear that the unstable stability classification is in good agreement with the observed data for the HIWAY model. The σ_z values for oblique and parallel cases cannot be computed from HIWAY since in these cases σ_y has also to be taken into account.

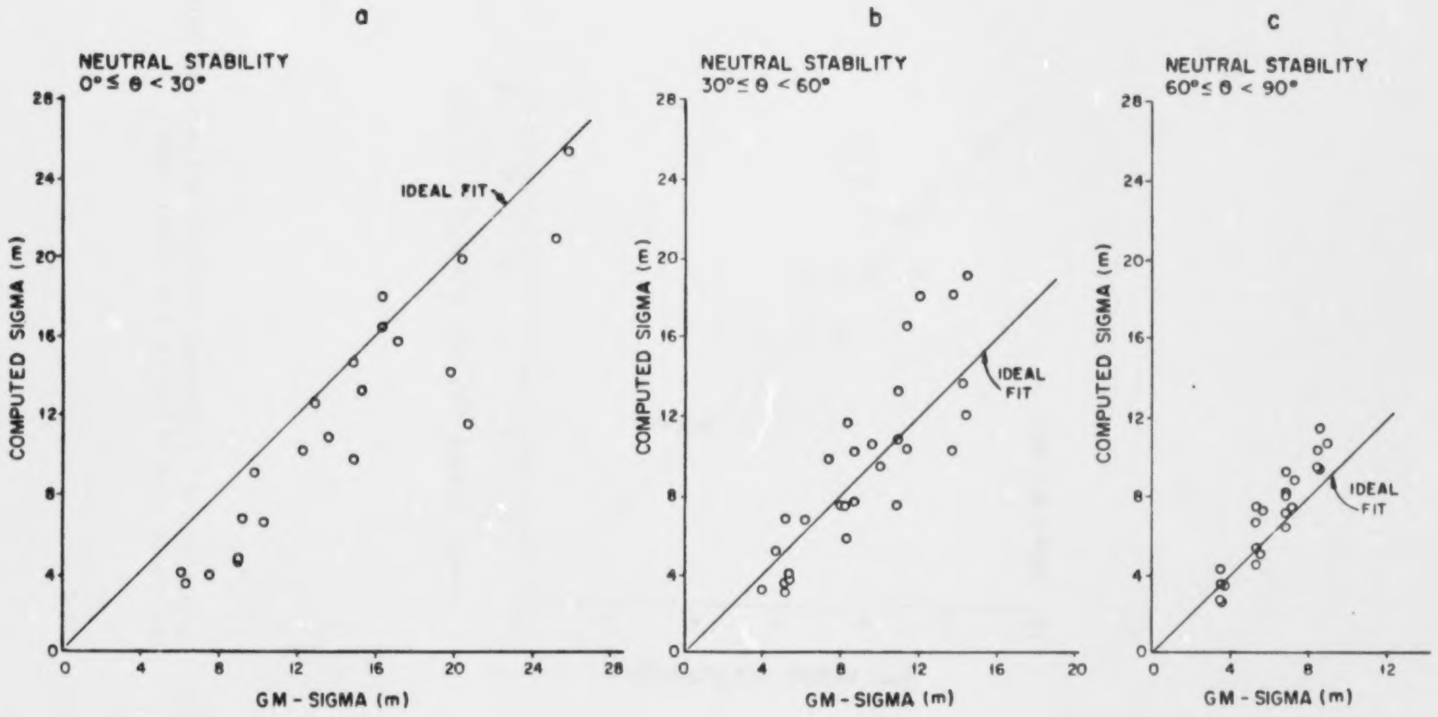


Figure 27 Sigma-z values computed in this study as compared with those specified in the GM model.

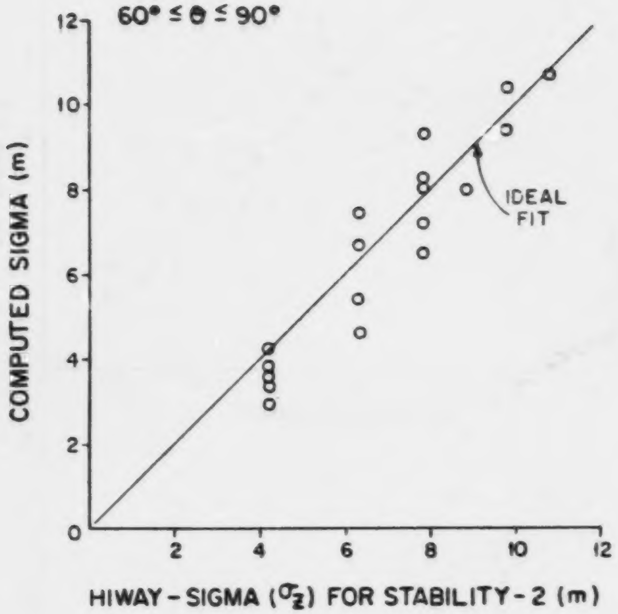


Figure 28 Comparison of computed vertical dispersion parameters and those specified in the HIWAY model.

Fig. 29 is a plot of the variation of the calculated sigma with downwind distance for perpendicular ($60^\circ \leq \theta \leq 90^\circ$) wind road angles. Also plotted for comparison are the sigma values from GM (neutral) and HIWAY (stability 2). The scatter is to be anticipated since the perpendicular case data set ranges from 60° to 90° wind-road angle while the GM and HIWAY values are computed for 90°. This implies that a simple linear equation of the form $\sigma_z = a + bx$ could represent the variation of σ_z with downwind distance for wind-road angles in the range of 60° to 90°. In addition, sigma values are computed from the standard deviation of the elevation angle (σ_ϕ) as follows. From the three component wind measurements at the roadway we obtain

$$(\sigma_\phi)_{t,s} = (\sigma_w)_{t,s} \; \bar{u}^{-1}$$

where the subscripts t,s represent the sampling period and the averaging time respectively, σ_w measurements are available for averaging times of 1, 5, 10 and 25 sec. for a sampling period of 10 minutes. The $(\sigma_\phi)_s$ values are averaged for the corresponding one hour SF_6 sampling periods since the variability in σ_ϕ between each 10 min. interval is quite small, and the $(\sigma z)_{t,s}$ are obtained from the relation (Pasquill, 1976)

$$(\sigma z)_{t,s} = (\sigma_\phi)_{t,s} x$$

where x is the downwind distance and the subscript t,s are the one hour sampling time and the appropriate averaging time respectively.

A linear regression between the calculated dispersion values and the dispersion values obtained using the standard deviation of elevation angle indicated an explained variance of 0.92 and an intercept of 1.17 for 1 sec. averaging time; and an explained variance of 0.89 and an intercept of 1.14 for 25 sec. averaging time. The values plotted in Fig. 29 are those obtained with an averaging time of 25 sec. for two cases of perpendicular wind conditions. Incidentally, the intercepts obtained, representative of the initial dispersion values, are in the range of initial dispersion values specified by the GM model ($\sigma_z = 1.14$m for neutral, and $\sigma_z = 1.20$m for unstable). The close agreement of the dispersion values specified in terms of σ_ϕ with those observed at the site suggests that for near-roadway dispersion problems, a better formulation is $\sigma_z \sim \sigma_\phi x$, rather than $\sigma_z \sim ax^b$, commonly used in the existing Gaussian highway models.

Another independent way to confirm the consistency of the calculated sigma values is to compare the sigma values computed from the concurrently observed carbon monoxide concentrations. Fig. 30 compares the sigma values from both carbon monoxide and tracer data. When all data points are considered, the explained variance is 0.78 and the slope is unity. This suggests that the dispersion of SF_6 is similar to that of CO. Hence, the models validated using SF_6 as a tracer gas can be confidently applied for modeling carbon monoxide.

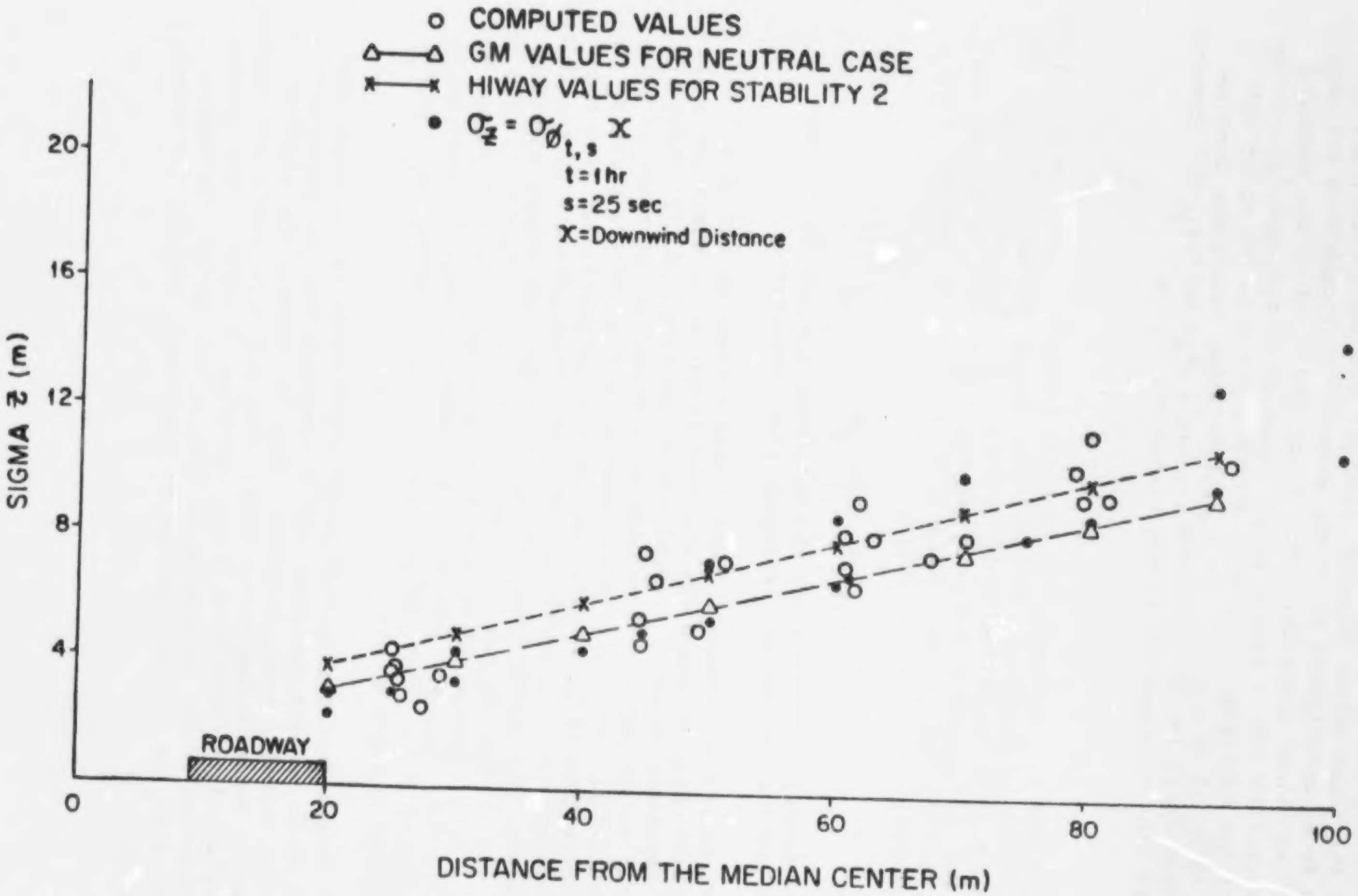


Figure 29 Vertical dispersion paremeter as a function of downwind distance from the source, computed from observed SF_6 concentrations and those derived from the σ_w measurements with an averaging time of 25 sec and a sampling time of one hour. Also indicated in the diagram are vertical dispersion parameters specified in the GM and HIWAY models.

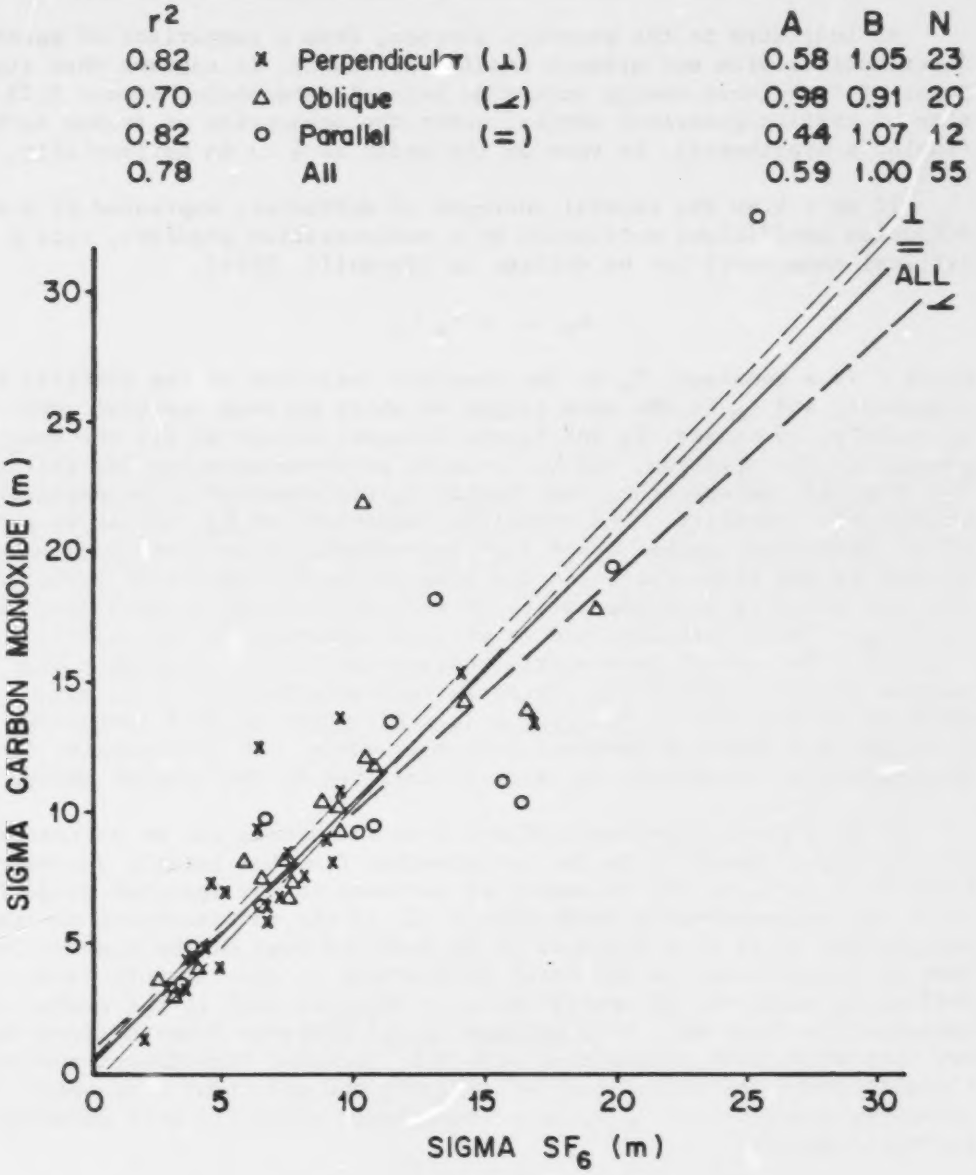


Figure 30 Comparison of sigma values obtained from the SF_6 and CO data.

Impact of Traffic-Induced Turbulence on Near-Roadway Dispersion

As indicated in the previous section, from a comparison of spectral distributions with and without traffic influence, it appears that significant input of turbulence energy occurs at natural frequencies around 0.25 H_z. The size of traffic-generated eddies, under the assumption of frozen turbulence (Taylor's hypothesis), is then on the order of 4 to 8m horizontally.

If we follow the general concepts of diffusion, expressed by a mean eddy diffusion coefficient multiplied by a concentration gradient, this K (for the vertical component) can be written as (Pasquill, 1974)

$$K_z = C \sigma_w \lambda_m$$

Where C is a constant, σ_w is the standard deviation of the vertical wind component, and λ_m is the wave length at which maximum spectral power occurs. In reality, of course, K_z and σ_w are integral values of all the Fourier components in the spectrum, and λ_m is taken as representative for this spectrum. The shape of the spectrum, and, hence, λ_m are supposed to be dependent on the atmospheric stability. The stability dependence of K_z, either as a function of the Richardson number or of the Monin-Obukhov length has been extensively treated in the literature. In the case of traffic-generated turbulence, however, there is an augmentation of turbulent energy at wave lengths well below λ_m. These turbulent eddies will be important for the near-roadway diffusion, but cannot be properly represented in K_z. Therefore, for the purpose of near-roadway dispersion a representation has to be sought, in which K_z is modified as $K_{z\ \mathrm{total}} = K_z + \Delta K$, where ΔK is a decreasing function of height and downwind distance from the source. In the Gaussian formulations the dispersion parameters may also be modified in the similar manner.

ΔK at a given downwind distance from the source can be estimated from $\Delta K = C_n \Delta\sigma_w \lambda_n$ where ΔK is the contribution from the locally generated turbulence to K, $\Delta \sigma_w$ is the increment of variance in the spectral range for which λn is the representative "eddy size"; C_n is the corresponding constant. Calculation of ΔK at a distance of 5m from the edge of the highway indicates that ΔK contribution to the total diffusivity in the unstable cases is about 3-4% of K_z while the ΔK contribution is about 40-100% in the stable case. Consequently there will be a maximum (x_{max}) distance downwind from the highway upto which both atmospheric stability (natural turbulence) and traffic (locally generated turbulence) will govern the pollutant dispersion. For distances greater than x_{max}, only atmospheric stability will determine the diffusion process.

A second mechanism which will severely affect the dispersion process close to the highway, is the aerodynamic drag due to the moving vehicles. The fact that wind profiles are distorted mainly if the wind has a component parallel to the highway, means that there is an altered dispersion in the direction of the road. It is possible that if the wake effects behind the moving vehicles are considered in the model formulation, the predictive capability of the model could be greatly improved. The implications of locally generated turbulence on the dispersion of pollutants are given in Rao et al (1978b).

Atmospheric Stability Determination

In the Gaussian models the dispersion parameters σ_y and σ_z are expressed as a function of the atmospheric stability class and downwind distance. It is common practice for model predictions to use the stability class, obtained from the nearby airport, which is derived from surface wind speed, cloud cover and ceiling height observations of the National Weather Service offices. A comparison is made between the stability classes determined from the Islip airport data and the experimental site data. The former is based on the standard Pasquill method and is available on an hourly basis. The latter is determined from bulk Richardson number. An attempt is made to relate the airport stability to the site stability and σ_ϕ. The road side stability, based on bulk Richardson number, was determined from the equation

$$R_{iB} = \frac{g z_1 z_2 \Delta T_k}{T_k (z_2 - z_1) \bar{U}_H^{\,2}} \times 100$$

for each hour, where $z_2 = 16$m and $z_1 = 5$m, T_k and ΔT_k being the temperature and temperature difference respectively and $\bar{U}_H$ the wind speed. The σ_ϕ value for each hour was obtained from $\sigma_w/\bar{U}_H$ using a 1 sec averaging time from the 8m height Gill sensor in the median.

Data for the months of Jan., Feb., Mar., were segregated according to the hourly Pasquill stability classes (based on the airport data). Table 23 list the percentage of occurrence for each stability class used in the analysis from the airport data which comprised 666 cases. The bulk Richardson number calculations were restricted to windspeeds ($\bar{U}_H$) $\geq$ 1.0m sec^{-1}. σ_ϕ and the bulk Richardson number for all the six stability classes are plotted in Figure 31. There is a considerable amount of scatter in the range of σ_ϕ values for a given stability class. Based on this diagram and following the arbitrary classification of Chock (1978) the data was divided into three stability classes and the percentage of occurrence of each class is listed in Table 24. Clearly the range of bulk Richardson numbers in the neutral stability class is too narrow. Hence, a new method of classification, based on the observed range of the bulk Richardson number in Fig. 31, is given in Table 25. The airport data in Table 23 indicates that 50% of the time neutral stability is prevalent while from Table 25 the percentage of occurrence of neutral stability drops to about 25%. This is due to the restricted range imposed on the value of the bulk Richardson number. It is evident from Fig. 31 that the scatter in the bulk Richardson number values for a given airport stability class is quite large. The scheme outlined in Table 25 appears to be in reasonable agreement with the data in Table 23 when classes 5 and 6 are combined together in each of the Tables. This implies that under stable conditions both schemes of classification are quite valid. However, at least 30% of the hours classified as neutral stability based on the airport data are unstable at the site.

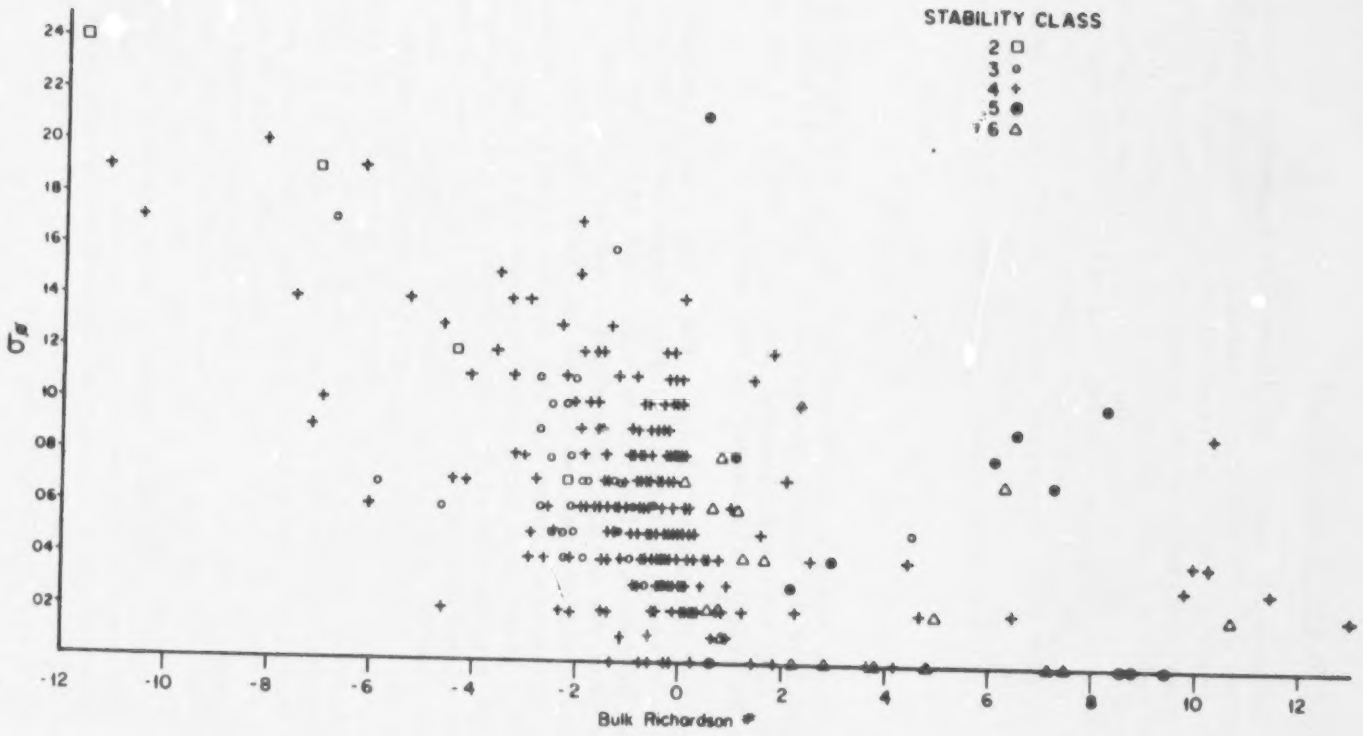


Figure 31 Plot of $^{\sigma}{}_{w}/u_H$ versus the bulk Richardson number.

% of Occurrence

Stability Class	% of Occurrence
1	0.3
2	0.9
3	9.0
4	53.0
5	26.3
6	10.5

TOTAL No. of cases is 666

TABLE 23 PERCENTAGE OF OCCURRENCE OF EACH STABILITY CLASS BASED ON AIRPORT DATA

Stability	Range of R_B	% of Occurrence
Unstable	≥ 0.1	54.6
Neutral	$0.07 \geq R_B > -0.1$	3.8
Stable	> 0.07	41.6

TABLE 24 PERCENTAGE OF OCCURRENCE OF EACH STABILITY CLASS BASED ON CHOCK'S STABILITY CLASSIFICATION

Stability Class	Range of R_B	% of Occurrence
1 & 2	< -1.5	15.2
3	$-1.5 < R_B < -0.05$	32.8
4	$-0.05 < R_B < 1.0$	25.1
5	$1.0 < R_B < 1.5$	3.6
6	$R_B > 1.5$	23.3

TABLE 25 PERCENTAGE OF OCCURRENCE OF EACH STABILITY CLASS BASED ON REVISED METHOD

SECTION 4

SUMMARY AND CONCLUSIONS

The management and analysis techniques of the aerometric and traffic data collected in this study were presented in section 2. Although the later traffic measurements with the detector loops imbedded in each lane of the highway were found to be unreliable, the availability of traffic films enabled a reasonable estimate of the traffic patterns of the highway. Most of the problems encountered in the traffic data are due to the variations in the sensitivity of the loop detectors. It was found that although the traffic measurement system is based on sound techniques, the applicability of this for continuous long-period data acquisition is questionable. For future studies, it is recommended that on-site traffic films be made and analyzed for traffic counts and classification. On a periodic basis, these two sets of data must be compared to ensure proper operation of the traffic detection system. Based on the analysis of all the data collected and the results of the model evaluation, the following conclusions can be drawn:

(1) With the present mix of catalyst equipped vehicles (about 30% of total population) over the Long Island expressway, the contribution of sulfate from the roadway is negligible. Therefore, the sulfur and sulfate concentrations adjacent to the Long Island expressway are indicative of the mesoscale environment at the site.

(2) The sulfate (as S)/sulfur (as S) ratio of 1.07, found at the site for all samples, indicates that within the limits of sampling error, all of the sulfur exists as sulfate.

(3) The main source of lead at the site is the highway. The significant increase in lead concentration due to the roadway suggests that the lead concentration in an urban situation (e.g. street canyons) could pose an air quality problem when a national ambient lead standard is set. Also, the highway is an important source for particulates.

(4) Under parallel wind-road orientations, the pollutant concentration (SF_6, in this case) falls off to 50% of the maximum at about 20m from the edge of the highway. For a road-side receptor, the concentration drops off by 60% at 8m height. There is a convergence of traffic-induced winds at low levels resulting in vertical motions on the roadway.

(5) Under perpendicular wind-road orientations, the pollutant concentration (SF_6, in this case) falls off to 50% of the maximum at a distance of 40m from the roadedge. For a road-side receptor, the concentration drops off by 80% at 8m height. Traffic-induced winds generally resulted in vertical motions over the highway.

(6) With significant moving traffic over the highway, there is noticeable augmentation of turbulent kinetic energy. This turbulent energy appears to be dominant at mean frequencies of 0.1 to 1.0Hz, corresponding to eddy sizes of a few meters, and is probably due to multiple wakes generated by the traffic.

(7) As revealed from a comparison of mean wind profiles close to the highway and at 21m distance from the highway, the aerodynamic drag due to the moving vehicles is significant. These effects are manifested by an acceleration of wind in the lowest 8m in cases of wind directions nearly parallel to the highway.

(8) In contrast to the findings of Dabberdt (1976), and Chock (1977), no organized convection can be distinguished in the spectral structure, even under quite stable atmospheric conditions.

(9) Of the eight models tested with the tracer data, only the predictions from the GM model are in excellent agreement with the observations. HIWAY model appears to predict the concentration profiles quite well indicating that the physics of the diffusion process is handled properly in the model. Taking explained variance as a measure of performance, the numerical models performed about the same as the above Gaussian models. In general, all the numerical models tested here overpredict the concentrations.

(10) The good correlation between the dispersion parameter values calculated from SF_6 data and CO data suggests that the dispersion of CO is similar to that of SF_6; hence, SF_6 tracer can be confidently used to validate CO dispersion models.

(11) Incorporation of vehicle-induced turbulence in the dispersion models, could significantly improve a dispersion model's simulation capability.

(12) The classical Pasquill-Turner stability classification may not properly represent the stability conditions near the roadways. It is suggested that the atmospheric stability adjacent to the highways may be determined through Richardson number (or bulk Richardson number) or wind fluctuation data obtained at the site. Although most tracer periods were conducted under near neutral atmospheric conditions as per the Pasquill-Turner typing, the on-site measurements indicated mostly unstable. This indicates that the mechanical turbulence due to the moving vehicles on the highway, tends to decrease the atmospheric stability immediately downwind of the highway.

(13) It is found that the dispersion parameter σ_z obtained from the standard deviation of the elevation angle (σ_ϕ) is in good agreement with the sigma's used by GM and HIWAY (unstable category) models, as well as the values calculated from the observed concentration profiles. Hence, it is suggested that for highway dispersion problems with a typical sampling time of one-hour, the dispersion parameters may be defined in terms of wind fluctuation (σ_ϕ or σ_θ) rather than a power law relation with downwind distance from the source.

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Appendix I

Appendix I contains the 318 CO data-hours used for modeling. The Julian date is followed by the starting time of the hour of interest. The wind speed is in m/sec, while the direction is in degrees. A northerly wind would be 0 or 360° (and is perpendicular to the highway) while an easterly parallel wind is 90°. The temperature is in $^{\circ}$F. The CO concentrations are in ppm. The stability is classified using the Pasquill Gifford schemes and is from the Islip airport.

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DAY	HR	WS	WDIR	TEMP	3A	5A	7A	9A	9B	9C	9D	STAB
97	5	1.8	284.	30.	.5	1.7	1.8	1.6	1.4	1.2	.9	4
97	6	2.2	276.	31.	1.5	3.7	3.3	2.5	2.2	1.9	1.5	4
97	7	3.7	295.	32.	.6	1.4	2.6	2.5	2.0	1.4	.9	4
97	8	3.7	298.	34.	.6	1.2	2.0	2.2	1.7	1.1	.7	4
97	9	3.6	298.	35.	.5	1.0	1.6	2.0	1.6	1.2	.8	4
97	10	3.3	276.	36.	1.0	1.7	2.1	2.1	1.6	1.4	1.1	4
97	15	4.2	242.	42.	2.0	3.4	2.3	.9	.8	.8	.6	4
97	16	3.9	206.	40.	2.6	4.3	3.9	1.1	1.1	1.1	1.1	4
97	17	3.8	206.	38.	2.4	3.2	2.4	1.0	1.0	1.0	1.0	4
98	6	3.0	267.	41.	1.0	3.3	2.4	1.8	1.9	1.6	1.2	4
98	7	4.9	291.	42.	.9	3.0	1.9	2.0	1.8	1.5	1.3	3
98	13	8.4	318.	40.	.6	.7	1.0	1.5	1.1	.6	.4	4
98	14	9.4	324.	39.	.6	.8	.9	1.5	1.1	.8	.6	4
98	15	8.0	319.	38.	.6	.9	.9	2.1	1.3	.7	.6	4
98	16	8.9	324.	37.	.6	.7	.8	2.2	1.2	.5	.5	4
98	17	7.7	323.	36.	.6	.7	.8	1.7	.9	.4	.2	4
98	18	6.5	322.	34.	.6	.7	.7	2.0	.9	.2	.1	4
99	14	4.4	310.	37.	.3	.8	1.1	1.5	1.1	.5	.4	4
99	15	5.1	316.	39.	.3	.5	1.0	1.6	1.1	.6	.5	4
99	16	4.8	327.	39.	.3	.5	1.0	1.6	1.1	.6	.5	4
99	17	3.7	332.	39.	.3	.5	1.1	1.7	1.1	.6	.5	4
99	18	2.4	334.	38.	.5	.6	1.4	2.2	1.5	.6	.5	4
99	21	.6	12.	30.	2.0	1.9	3.3	3.8	3.5	3.0	2.3	4
99	22	.6	17.	28.	2.0	2.3	3.4	3.6	3.4	2.6	2.0	4
100	6	2.4	295.	34.	.9	1.0	1.2	1.2	1.0	1.1	.8	4
100	7	3.2	303.	37.	.6	.6	.8	.9	.6	.6	.4	4
100	8	4.4	322.	39.	.3	.4	.7	.8	.5	.4	.4	4
100	10	2.9	324.	44.	.3	.6	1.2	1.4	1.1	.6	.4	3
100	14	3.9	295.	51.	.4	1.0	1.5	2.0	1.5	1.0	.7	4
100	15	3.4	283.	52.	.4	1.0	1.2	1.9	1.5	1.0	.7	4
100	16	4.5	224.	47.	1.1	1.8	.8	.7	.6	.6	.6	4
100	17	3.4	226.	45.	1.4	2.4	1.1	.6	.5	.6	.5	4
100	18	2.0	230.	43.	2.0	3.8	1.6	.8	.7	.6	.6	4
100	21	.3	256.	38.	3.3	4.1	4.3	3.0	2.7	2.3	1.9	6
100	22	.2	61.	37.	3.6	3.9	5.4	5.4	5.2	4.9	4.3	6
101	0	1.3	39.	36.	3.3	3.3	3.9	4.0	3.7	3.0	2.3	6
101	1	.4	37.	35.	2.8	2.9	3.1	3.1	2.9	2.3	1.8	6
101	2	.5	4.	33.	3.0	2.9	3.0	2.7	2.7	2.5	2.1	6
101	6	3.4	105.	39.	1.3	3.6	1.1	.7	.6	.4	.4	4
101	7	2.3	125.	40.	2.3	5.1	1.4	.6	.5	.4	.3	3

DAY	HR	WS	WDIR	TEMP	3A	5A	7A	9A	9B	9C	9D	STAB
101	8	3.3	135.	44.	1.8	3.9	1.3	.4	.3	.4	.3	4
101	9	4.1	134.	44.	1.0	2.3	1.3	.6	.5	.5	.7	3
101	10	3.9	141.	46.	1.0	1.6	1.2	.5	.5	.5	.4	3
101	13	4.0	169.	48.	1.6	2.8	1.1	.3	.2	.2	.2	4
101	14	4.1	178.	49.	2.4	5.0	1.3	.5	.4	.5	.4	4
101	16	2.9	189.	49.	2.1	3.0	2.2	.7	.7	.7	.7	4
101	17	2.6	192.	48.	2.4	3.9	3.9	.7	.9	.9	.8	4
101	18	1.9	191.	46.	2.0	3.5	3.1	.7	.6	.6	.6	4
101	21	1.4	213.	45.	1.5	1.8	1.5	.9	.9	.9	.9	6
102	6	1.3	221.	49.	3.6	5.1	2.5	1.5	1.5	1.5	1.5	4
102	7	3.7	261.	60.	4.5	8.8	4.7	2.8	2.7	2.7	2.3	4
102	8	3.3	263.	66.	4.5	7.5	6.0	4.4	4.3	4.0	3.5	4
102	9	3.2	265.	71.	3.8	5.8	4.6	4.5	4.1	3.6	3.2	4
102	10	3.7	277.	76.	1.7	3.5	3.1	3.0	2.6	2.2	1.8	4
102	15	4.7	323.	84.	.1	.1	1.4	4.2	3.4	.6	.3	4
102	16	4.3	334.	84.	.0	.2	1.6	6.7	3.7	1.1	.9	4
102	17	3.4	343.	82.	.1	.4	1.7	6.9	4.0	1.2	.9	4
102	18	2.0	351.	77.	.6	.8	2.2	5.1	3.8	1.7	1.1	4
102	21	1.8	16.	67.	3.9	4.1	4.6	5.7	5.1	3.8	2.7	6
102	22	.7	58.	66.	4.3	4.8	5.0	5.4	5.0	4.2	2.8	5
103	5	.2	137.	49.	3.0	3.8	3.1	2.7	2.6	2.5	2.1	6
103	6	.5	116.	53.	5.0	7.0	4.1	2.8	2.9	3.0	3.0	4
103	7	.9	219.	63.	6.3	9.3	5.8	4.6	4.4	4.3	4.2	4
103	8	2.1	244.	72.	5.0	7.7	4.3	2.9	2.9	2.7	2.5	4
103	9	2.9	250.	76.	4.1	5.6	4.0	2.8	2.8	2.6	2.4	4
103	10	3.5	246.	78.	2.8	4.3	3.1	2.2	2.1	1.8	1.8	4
103	14	4.2	281.	83.	.4	1.2	2.0	2.7	2.2	1.3	.8	4
103	15	4.2	280.	83.	.4	1.7	2.6	4.1	3.3	2.2	1.5	4
103	16	4.3	269.	82.	.8	2.6	3.7	6.0	4.8	3.0	1.9	4
103	17	3.0	261.	81.	1.7	3.9	6.1	5.0	4.6	3.5	2.5	4
103	18	3.5	248.	77.	2.6	4.9	4.4	1.7	1.8	1.7	1.6	4
103	21	3.0	248.	71.	2.1	2.7	2.4	1.4	1.5	1.4	1.4	5
103	22	2.9	243.	69.	1.8	2.6	2.2	1.5	1.3	1.2	1.2	5
104	5	6.1	343.	60.	.1	.4	1.1	.9	.9	.6	.4	6
104	6	6.4	359.	54.	.1	.6	1.8	1.5	1.2	.5	.4	3
104	7	6.7	358.	53.	.2	.4	2.0	1.8	1.2	.4	.3	2
104	8	6.0	341.	54.	.1	.2	1.9	2.0	1.3	.4	.3	3
104	9	5.3	335.	55.	.1	.4	1.4	1.7	1.3	.8	.6	3
104	10	.0	5.	57.	.3	.5	1.3	1.6	1.0	.7	.4	3
104	16	7.0	338.	63.	.0	.3	.7	2.5	1.5	.8	.9	4

DAY	HR	WS	WDIR	TEMP	3A	5A	7A	9A	9B	9C	9D	STAB
104	17	6.2	333.	61.	.0	.2	.7	3.1	1.7	.8	.6	4
104	18	4.9	324.	59.	.0	.2	.7	3.4	2.2	1.1	.9	4
104	21	3.2	22.	51.	.4	.3	.5	1.8	1.5	.8	.7	5
104	22	3.6	17.	49.	.3	.3	.5	1.5	1.0	.6	.5	5
105	0	4.7	6.	47.	.3	.3	.4	1.0	.8	.5	.6	5
105	1	3.4	17.	46.	.2	.3	.3	1.0	.9	.7	.7	4
105	2	4.3	14.	44.	.2	.3	.3	.8	.4	.4	.4	4
105	5	.9	19.	40.	.9	1.6	1.8	1.2	1.0	.9	.6	4
105	6	1.1	29.	44.	.8	2.0	3.5	3.0	2.7	1.9	1.2	4
105	7	2.5	30.	47.	.4	.5	3.8	3.2	2.5	1.3	.6	4
105	9	2.1	277.	51.	1.2	1.8	1.9	1.8	1.6	1.3	.7	4
105	10	2.5	264.	53.	1.5	2.2	2.1	1.8	1.5	1.3	1.0	4
105	13	4.7	228.	56.	1.8	2.5	1.5	1.1	1.2	1.1	1.1	4
105	14	4.7	221.	56.	1.8	2.6	1.5	.7	.6	.7	.6	4
105	16	3.7	223.	54.	2.8	3.9	3.7	.8	.8	.8	.7	4
105	17	3.3	224.	54.	3.4	4.3	4.3	1.2	1.2	1.1	1.1	4
105	18	1.0	209.	51.	3.9	4.9	5.1	2.0	1.9	1.7	1.5	4
105	21	4.6	5.	52.	.0	.3	1.0	1.9	1.3	.8	.7	4
105	22	3.2	355.	50.	.0	.2	1.1	1.7	1.3	.7	.7	4
106	0	3.0	324.	47.	.0	.2	1.0	1.8	1.4	.8	.8	5
106	1	2.5	325.	45.	.3	.5	1.3	1.9	1.4	.9	.7	6
106	5	.4	58.	39.	1.5	2.3	2.4	1.9	1.7	1.6	1.0	6
106	6	1.6	3.	44.	.6	.6	2.2	2.3	2.0	1.2	.7	3
106	7	3.6	355.	48.	.1	.3	1.3	1.6	1.2	.6	.4	2
106	8	4.3	355.	50.	.1	.3	1.1	1.6	1.1	.4	.5	3
106	9	4.5	345.	52.	.1	.4	1.1	1.6	1.1	.6	.5	3
106	10	4.7	336.	55.	.1	.4	1.0	1.7	.9	.5	.5	4
106	13	5.3	336.	62.	.0	.3	1.0	1.7	1.1	.4	.3	4
107	14	1.2	350.	62.	.0	.5	1.3	2.2	1.9	1.0	.7	4
107	16	2.9	200.	56.	.5	2.1	1.2	.6	.6	.6	.6	4
107	17	2.4	195.	53.	.6	2.6	1.0	.6	.7	.7	.7	4
107	18	1.5	197.	49.	1.1	3.1	1.2	.6	.6	.6	.7	4
107	21	1.0	221.	45.	2.1	3.2	1.7	1.1	1.0	1.0	.9	6
107	22	.8	219.	44.	2.4	3.2	2.0	1.2	1.1	1.0	1.0	5
108	0	.7	212.	44.	2.7	2.9	2.2	1.7	1.7	1.8	1.5	5
108	1	.3	218.	43.	2.0	2.1	1.8	2.2	2.1	2.0	1.7	5
108	5	.6	269.	47.	1.8	3.6	2.4	1.9	1.8	2.0	1.8	5
108	6	1.0	251.	50.	3.2	5.6	3.0	1.6	1.5	1.7	1.5	4
108	7	1.6	250.	54.	3.1	5.8	3.1	1.7	1.8	1.6	1.4	4
108	8	1.6	252.	57.	3.1	6.6	3.8	2.5	2.3	2.1	1.9	4

DAY	HR	WS	WDIR	TEMP	3A	5A	7A	9A	9B	9C	9D	STAB
108	9	1.3	288.	61.	1.7	3.5	2.9	2.7	2.5	2.1	1.8	4
108	10	1.6	309.	63.	.5	1.7	1.5	2.2	1.8	1.1	.9	3
108	21	.8	199.	48.	1.7	2.0	2.1	1.2	1.1	.9	.9	6
109	0	.9	8.	41.	2.2	2.4	3.3	3.9	3.5	3.0	2.4	6
109	1	.7	7.	40.	2.2	2.6	3.0	4.0	3.6	3.0	2.1	6
109	2	.5	30.	39.	1.4	1.9	2.4	2.7	2.6	2.1	1.8	6
109	5	1.7	30.	46.	1.2	1.6	2.9	2.4	2.1	1.9	1.3	6
109	6	2.1	26.	51.	1.5	1.8	4.1	3.4	2.9	2.2	1.5	3
109	7	3.1	26.	58.	1.2	1.3	3.8	3.5	2.9	1.5	1.0	3
109	8	3.2	38.	62.	.7	.9	3.6	3.3	2.4	1.1	.5	4
109	9	2.6	42.	64.	.6	.7	2.5	2.7	2.1	1.2	.6	3
109	10	2.7	44.	66.	.5	.6	1.7	2.1	1.7	1.0	.7	3
109	13	3.2	174.	67.	.8	2.0	1.2	.5	.5	.5	.5	4
109	14	3.8	160.	64.	.8	1.9	1.0	.4	.4	.3	.5	4
109	15	3.1	163.	63.	1.3	2.6	1.9	.7	.5	.5	.5	4
109	16	4.0	146.	61.	1.5	2.7	2.1	.4	.5	.3	.2	4
109	17	4.2	142.	58.	1.4	2.4	1.6	.2	.2	.2	.2	4
109	18	3.2	138.	54.	1.4	1.9	1.7	.3	.3	.3	.3	4
109	21	.5	157.	47.	1.1	2.0	1.5	1.3	1.1	.7	.8	6
109	22	1.1	13.	46.	.6	1.0	1.2	2.5	2.0	1.0	.6	5
110	0	1.2	30.	42.	1.0	1.1	1.3	2.4	2.1	1.4	.9	6
110	1	1.0	37.	41.	.4	.8	.7	1.6	1.3	.7	.5	6
110	13	2.5	183.	59.	.9	1.5	1.1	.5	.3	.3	.4	4
110	14	1.5	191.	59.	1.0	1.7	1.1	.3	.3	.4	.5	4
110	15	.4	120.	58.	1.4	2.3	1.8	.4	.4	.4	.4	4
110	16	.3	125.	56.	2.0	2.7	3.1	.3	.2	.2	.1	4
110	17	.3	122.	56.	2.2	2.8	3.4	.4	.4	.4	.4	4
110	18	.1	185.	53.	2.2	2.7	3.0	.6	.4	.5	.5	4
110	21	.1	240.	49.	.9	1.5	2.3	2.7	2.3	2.0	1.2	6
110	22	.2	261.	47.	2.1	2.6	3.7	4.3	3.9	3.3	2.0	6
111	0	.1	180.	45.	2.4	2.4	3.4	3.9	3.7	3.2	2.4	6
111	1	.1	151.	43.	3.0	3.0	3.6	4.0	3.7	3.2	2.3	6
111	2	.1	165.	43.	2.0	2.3	2.8	2.9	2.6	2.1	1.6	5
111	8	.4	275.	59.	2.3	4.9	4.2	3.4	3.3	2.8	2.2	3
111	9	.8	280.	63.	2.4	3.9	2.8	1.8	1.7	1.6	1.7	3
111	10	1.2	281.	66.	2.2	2.9	2.0	1.5	1.4	1.6	1.3	3
112	8	1.3	279.	64.	4.1	6.9	3.0	1.8	1.5	1.6	1.7	2
112	13	1.0	278.	72.	2.1	3.3	1.8	1.3	1.2	1.1	1.1	2
112	15	.7	273.	70.	2.2	3.6	2.4	1.4	1.3	1.2	1.0	4
112	16	1.0	277.	68.	2.9	4.5	3.7	1.7	1.6	1.4	1.4	3

DAY	HR	WS	WDIR	TEMP	3A	5A	7A	9A	9B	9C	9D	STAB
112	17	.6	273.	65.	3.2	4.6	4.4	1.7	1.7	1.7	1.5	4
112	18	.7	274.	63.	2.7	4.3	3.8	1.5	1.6	1.5	1.3	4
113	6	.9	227.	61.	1.1	2.9	1.4	.7	.8	.6	.6	4
113	7	1.2	238.	65.	1.9	3.9	2.0	1.0	1.0	1.1	1.1	3
113	8	1.7	235.	67.	2.2	3.9	2.5	1.1	1.1	1.1	1.1	4
113	9	.6	226.	70.	2.1	4.0	2.6	1.4	1.4	1.1	1.1	3
113	10	.6	209.	72.	1.7	3.7	2.6	1.4	1.2	1.1	.8	3
113	13	.3	264.	70.	1.3	2.2	2.6	1.1	1.2	1.2	1.2	4
113	16	3.9	107.	51.	.9	2.9	2.4	1.3	1.1	1.0	.9	4
113	17	.0	4.	49.	.5	2.5	2.3	1.6	1.5	1.2	.9	4
113	18	4.0	107.	48.	.6	2.7	2.3	1.6	1.3	1.0	.9	4
114	7	2.0	108.	44.	.2	.3	1.1	1.2	.9	.6	.6	4
114	8	1.9	108.	44.	.2	.5	1.2	1.4	1.0	.6	.5	4
114	9	2.6	108.	44.	.3	.5	1.3	1.6	1.2	.7	.5	4
114	10	2.7	108.	45.	.3	.5	1.7	1.9	1.5	1.0	.6	4
114	22	5.2	34.	40.	.2	.4	1.1	1.1	.6	.4	.3	4
115	14	.8	232.	51.	1.8	3.5	2.5	2.6	2.2	1.8	1.2	4
115	15	2.0	208.	50.	3.2	5.5	4.8	2.2	2.1	2.1	1.9	4
115	17	1.7	201.	49.	3.5	5.7	6.2	2.4	2.4	2.4	2.4	4
115	22	.4	213.	41.	1.9	3.4	2.3	1.7	1.7	1.4	1.3	4
116	5	.6	143.	42.	2.5	5.1	1.8	1.2	1.2	.8	.6	4
116	7	.6	167.	44.	4.2	7.5	3.9	2.9	2.4	2.0	1.7	4
116	8	1.2	197.	45.	2.6	4.6	3.1	1.8	1.8	1.8	1.8	4
116	9	1.5	198.	45.	1.6	3.3	1.8	.9	.8	.9	.9	4
116	10	1.6	199.	45.	1.2	2.6	1.4	.6	.6	.6	.4	4
116	13	1.3	159.	46.	1.6	2.9	2.3	.9	.7	.7	.7	4
116	14	1.6	174.	47.	2.0	3.3	2.7	.9	.8	.7	.8	4
116	15	2.5	184.	46.	2.1	3.8	4.2	.7	.6	.7	.6	4
116	16	2.0	189.	44.	2.3	4.0	5.2	.7	.6	.7	.6	4
116	17	1.7	189.	44.	1.6	2.9	3.6	.5	.4	.6	.4	4
116	18	1.6	193.	43.	1.1	1.9	2.3	.5	.6	.4	.6	4
116	21	.4	209.	43.	1.6	2.4	2.1	.7	.7	.6	.6	4
116	22	.8	196.	43.	1.3	2.0	1.9	.5	.7	.6	.6	6
117	5	.5	122.	42.	2.4	4.8	1.8	.9	.7	.5	.4	4
117	7	.5	198.	44.	2.9	6.5	3.5	1.7	1.5	1.1	.8	4
117	8	1.0	218.	46.	2.4	4.2	3.2	1.5	1.4	1.2	1.1	4
117	9	1.1	189.	49.	1.8	3.2	2.6	1.2	1.1	.9	.9	4
117	10	2.2	209.	50.	1.1	2.1	1.7	.7	.7	.6	.5	4
117	13	1.3	199.	46.	1.9	3.3	2.1	1.0	.9	.8	.8	4
117	14	2.7	213.	50.	1.6	3.2	2.5	.7	.7	.9	.7	4

DAY	HR	WS	WDIR	TEMP	3A	5A	7A	9A	9B	9C	9D	STAB
117	22	1.2	219.	45.	2.3	3.3	2.2	1.7	1.5	1.2	1.0	4
118	7	3.7	225.	52.	2.7	5.1	2.5	1.0	1.0	1.0	1.0	4
118	8	3.1	237.	53.	2.8	4.6	2.7	1.3	1.2	1.2	1.2	3
118	9	3.2	241.	55.	2.6	2.8	2.9	1.4	1.3	1.4	1.2	4
118	10	2.4	249.	57.	2.9	4.4	3.8	2.2	2.2	2.1	1.8	4
119	7	5.8	358.	38.	.1	.6	1.8	2.0	1.2	.3	.1	4
119	8	4.5	337.	40.	.2	.6	1.3	1.7	1.2	.4	.2	4
119	9	5.2	353.	42.	.2	.6	1.0	1.5	.8	.2	.2	4
119	10	4.9	338.	44.	.1	.5	.7	1.3	.8	.2	.2	4
119	13	4.6	323.	51.	.3	.3	.8	1.9	1.3	.5	.3	4
119	14	4.8	323.	53.	.2	.4	.9	2.6	1.4	.4	.2	4
119	15	4.6	318.	54.	.3	.4	.9	4.6	2.3	.7	.2	4
119	16	.3	5.	55.	.3	.4	.7	3.6	1.7	.4	.3	4
119	17	3.3	312.	55.	.3	.4	.8	4.2	2.3	.7	.3	4
119	18	2.5	321.	53.	.3	.5	1.0	3.3	2.2	.7	.3	4
119	21	.2	7.	41.	3.3	3.5	3.8	4.4	3.9	3.2	2.4	4
119	22	.4	349.	39.	4.0	4.1	4.7	5.0	4.5	4.1	3.4	4
120	0	.8	318.	39.	3.7	3.8	4.3	4.9	4.7	3.5	3.0	6
120	1	1.3	273.	42.	3.0	3.3	4.1	4.0	4.0	3.5	1.6	4
120	8	1.5	16.	52.	.3	.6	2.1	2.4	1.8	.7	.4	4
120	9	.5	14.	55.	.2	1.2	1.9	2.0	1.5	.8	.4	4
120	10	.4	337.	57.	.2	1.0	1.8	2.4	2.0	.8	.4	4
120	13	3.0	201.	60.	1.3	2.7	2.3	1.1	1.0	1.0	.9	4
120	14	2.7	195.	61.	1.6	2.8	2.4	.9	.9	.9	.9	4
120	15	3.7	207.	59.	1.4	2.6	2.1	.7	.8	.7	.8	4
120	16	3.5	207.	56.	1.5	2.8	2.8	.4	.4	.5	.4	4
120	22	1.0	205.	46.	1.8	3.0	1.7	1.2	1.1	1.0	.9	6
121	0	.2	247.	44.	1.8	2.3	2.4	2.2	2.2	1.8	1.3	6
121	1	.3	220.	43.	2.1	2.4	2.3	1.9	2.2	2.0	1.6	5
121	2	.6	10.	40.	2.5	2.6	2.7	3.1	2.8	2.5	1.7	6
121	5	.0	127.	38.	1.7	2.2	3.1	3.4	3.3	3.0	2.7	6
121	7	.3	240.	54.	1.7	2.9	3.2	2.8	2.5	2.3	2.1	3
121	8	1.5	234.	60.	1.8	3.2	2.7	1.6	1.7	1.7	1.7	3
121	9	2.3	237.	64.	1.5	3.2	2.7	1.2	1.0	1.1	.9	2
121	10	3.3	223.	66.	1.3	2.9	2.2	.6	.6	.5	.6	2
129	8	1.5	318.	40.	.4	1.3	4.1	5.1	3.6	2.3	1.8	3
131	6	1.7	282.	48.	.2	.6	4.1	3.3	2.4	1.0	.3	4
131	7	1.8	282.	52.	.0	.5	2.5	2.3	1.6	.5	.1	4
131	14	2.6	282.	61.	.3	.4	.8	2.4	1.2	.3	.1	4
131	15	2.1	282.	62.	.3	.4	1.2	3.5	1.7	.5	.2	4

DAY	HR	WS	WDIR	TEMP	3A	5A	7A	9A	9B	9C	9D	STAB
131	16	1.5	280.	62.	.2	.5	1.3	3.5	1.7	.3	.2	4
131	17	1.3	279.	61.	.2	.4	1.2	3.2	1.8	.4	.2	4
132	8	2.5	282.	63.	.4	1.1	2.6	3.0	2.2	1.2	.6	4
132	9	2.2	281.	65.	.6	1.6	2.0	2.6	2.0	1.4	.9	4
132	10	2.7	283.	67.	1.0	1.2	2.1	2.4	1.5	1.1	.7	4
132	12	2.4	282.	70.	1.1	1.9	1.7	1.6	1.4	1.0	.7	3
132	14	2.1	281.	69.	2.1	3.4	2.4	.7	.6	.6	.5	4
132	15	1.5	281.	67.	2.4	4.2	3.1	.5	.5	.5	.4	4
132	16	1.1	279.	66.	2.8	5.1	4.5	.7	.7	.8	.7	4
132	17	.6	273.	64.	3.4	5.3	4.6	.9	.9	.8	.8	4
132	21	.7	275.	62.	3.4	3.5	4.5	4.3	3.9	3.4	3.1	6
132	22	1.9	281.	64.	1.7	1.7	2.5	3.2	2.6	1.9	1.6	6
133	0	1.7	286.	61.	1.0	1.2	1.8	2.1	2.1	1.8	1.2	6
133	1	2.8	292.	61.	.4	.5	.6	.9	.7	.5	.4	6
133	4	1.8	278.	58.	.6	2.0	2.2	1.4	1.4	1.1	.8	5
133	6	3.2	284.	61.	.9	2.3	3.9	3.7	2.9	1.9	1.0	4
133	7	4.5	300.	63.	.7	1.3	3.1	3.0	2.3	1.3	.7	3
133	8	4.5	312.	65.	.4	.6	1.8	2.3	1.6	.7	.3	3
133	9	5.3	329.	66.	.2	.4	1.1	1.5	1.0	.3	.1	4
134	12	5.5	345.	60.	.3	.5	.8	4.6	1.6	.3	.2	3
134	13	5.6	343.	62.	.2	.3	.8	4.7	1.7	.3	.2	3
134	14	5.1	337.	63.	.1	.5	.8	2.2	1.0	.2	.1	4
134	15	5.5	336.	64.	.1	.4	.8	1.7	1.0	.2	.1	4
134	16	5.2	340.	64.	.1	.4	.7	1.7	.9	.2	.2	4
134	17	4.4	343.	63.	.1	.4	.9	1.8	.9	.2	.1	4
134	18	2.9	349.	61.	.2	.5	1.3	2.1	1.4	.4	.2	4
134	20	.8	21.	51.	2.2	2.4	3.6	4.7	4.1	3.1	2.3	4
134	21	1.5	7.	49.	2.8	2.9	3.8	5.1	4.6	3.3	2.4	4
134	22	3.2	5.	50.	.8	1.1	1.5	2.6	2.0	.9	.7	5
135	0	1.6	7.	48.	.7	.8	1.5	2.4	1.9	.9	.6	6
135	1	1.3	18.	46.	.6	.8	1.4	1.8	1.6	.8	.6	6
135	6	3.5	356.	50.	.2	.3	1.0	.8	.4	.1	.1	4
135	9	3.9	356.	58.	.4	.4	.9	1.4	.7	.2	.2	4
135	12	4.3	355.	62.	.1	.4	1.2	1.7	1.0	.2	.2	3
135	13	3.8	359.	64.	.2	.5	1.4	2.0	1.2	.4	.2	3
135	14	3.6	355.	65.	.1	.4	1.7	2.3	1.4	.3	.1	4
135	15	3.0	353.	66.	.1	.5	1.9	2.1	1.4	.5	.3	4
135	16	1.7	339.	67.	.2	.7	2.1	2.5	1.8	.8	.3	4
135	17	.6	338.	66.	.2	1.1	2.7	2.9	2.3	1.0	.3	4
135	21	.8	212.	52.	2.7	4.2	2.3	1.0	.9	.8	.6	6

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DAY  HR   WS  WDIR TEMP   3A   5A   7A   9A   9B   9C   9D  STAB

135  22   .6  224.  51.  2.3  3.4  2.2   .9   .8   .8   .6    5
136   1   .2  203.  48.  1.0  1.5   .9   .7   .7   .5   .5    5
136   6   .0  300.  51.  1.1  2.6  5.3  4.7  4.3  3.4  2.7    4
136   7   .1  286.  57.  2.5  4.6  6.7  5.6  5.3  4.4  3.5    4
136   8   .1  246.  63.  1.9  3.5  4.2  4.1  3.8  3.0  2.3    4
136   9  1.3  249.  66.  2.0  3.3  2.9  2.7  2.6  2.3  2.1    4
136  12  2.0  297.  72.  1.4  2.2  2.3  2.9  2.5  1.8  1.4    3
136  13  2.0  290.  74.   .5  1.5  1.9  2.5  2.0  1.2   .8    3
136  14  3.9  221.  69.  1.5  2.6  2.5  1.2  1.2  1.1  1.1    4
136  15  2.8  214.  68.  2.0  3.3  3.9  1.3  1.3  1.3  1.2    4
136  16  3.4  221.  68.  1.7  3.4  4.3  1.2  1.1  1.1  1.1    4
136  17  2.8  222.  65.  1.3  2.6  2.9  1.0   .9  1.0   .9    3
136  18  1.6  218.  63.  1.2  2.6  2.6  1.1   .9  1.1  1.0    4
136  20  1.6  209.  56.  2.4  3.0  2.9  1.8  1.6  1.7  1.7    5
136  21  1.4  213.  56.  2.0  2.7  2.5  1.4  1.3  1.3  1.3    6
137   0  1.1  241.  58.  1.7  1.7  1.5   .8   .8   .9   .9    0
137   6  1.8  243.  60.  4.8  6.9  3.7  1.9  1.9  1.7  1.7    0
137   8  1.3  258.  70.  3.5  4.9  4.1  3.4  3.2  2.7  2.4    0
137   9  1.7  289.  74.  2.0  3.2  3.2  3.2  2.7  2.1  1.5    0
137  12  2.3  296.  82.   .2  1.6  2.4  3.3  2.7  1.8  1.3    0
137  13  2.7  240.  83.  1.3  2.8  3.2  2.5  2.1  1.7  1.2    0
137  14  4.1  225.  81.  1.9  3.7  3.7  1.8  1.8  1.8  1.7    0
137  15  3.9  226.  79.  2.2  4.0  4.4  1.6  1.6  1.6  1.5    0
137  16  3.2  220.  77.  2.5  4.3  5.8  1.6  1.6  1.4  1.5    0
137  17  2.3  215.  74.  2.6  3.5  3.9  1.4  1.4  1.4  1.5    0
137  18  1.7  216.  71.  2.2  3.3  3.9  1.4  1.2  1.2  1.2    0
137  20   .8  208.  64.  2.4  3.3  2.9  1.8  1.7  1.6  1.8    0
137  21  1.1  230.  66.  3.0  3.6  3.0  1.9  1.9  1.9  2.1    0
137  22  1.5  251.  67.  4.3  4.5  3.9  2.4  2.4  2.3  1.9    0
138   0  1.7  271.  69.  2.8  3.1  3.4  3.7  3.5  3.0  2.3    0
138   1  1.5  284.  70.  1.5  2.0  2.1  2.5  2.1  1.8  1.5    5
138   6   .9  293.  72.  1.7  4.8  5.4  5.0  4.3  3.1  1.7    4
138   7  1.9  308.  74.  1.4  2.7  5.3  5.3  4.5  3.1  1.4    4
140  12  2.8  209.  68.  3.7  4.1  2.2  1.1   .9  1.0   .9    4
140  13  3.1  213.  68.  3.8  4.3  2.3   .9   .9  1.0   .8    4
140  15  3.2  208.  64.  4.6  5.1  3.2   .8   .8   .7   .8    4
140  16  3.3  209.  62.  4.4  4.8  3.9   .7   .6   .6   .6    4
140  17  3.5  210.  60.  3.3  4.3  3.0   .4   .5   .4   .5    4
>
```

Appendix II

Appendix II contains the 147 dichotomous sampler runs used for modeling. The data comes in blocks of 13 lines. The first number in each line is the run identification number. It is the month and day (October, 1976 to May, 1977), followed by whether it was the first or second run of the day. On the first line the run number is followed by the wind direction in degrees, using the same reference system as the CO data; next is the wind speed in m/sec. Then the temperature is listed in °C. The next two numbers are the times of the day which bracket the sampling interval. The last four numbers are the traffic estimates in vehicles per hour, for westbound light duty and heavy duty, and eastbound light duty and heavy duty. The next twelve lines are the data for the six pollutants. The first line is the fine fraction, while the second is the coarse. The six are:

1 particulate weight
2 sulphate
3 sulphur
4 lead
5 chloride
6 nitrate

The unit are in $\mu g/m^3$. A -888 indicates that the position was never sampled or the filter not analyzed, while a -999 indicates the analysis yielded an unreportable result. A minus before any other number indicates the result was reported as less than that value. The columns correspond to the following positions: 3A, 5B, 5A, 9A, 9B, 11A, 11B, 12A, 13A.

```
10081   189.    2.07   19.1   9: 0  11:10  2913   435 1921   287
10081  1  -888.0-888.0  65.0  46.0  37.0  48.0  30.0  41.0  39.0
10081  1  -888.0-888.0  28.0  23.0  21.0  32.0  20.0  30.0  21.0
10081  2  -888.0-888.0   8.9   8.7   8.9   8.6   8.9   8.2   8.6
10081  2  -888.0-888.0    .3    .6   1.1-999.0    .6   1.6   1.0
10081  3  -888.0-888.0   2.9   3.2   2.9   3.1   3.2   3.0   3.0
10081  3  -888.0-888.0    .2   -.1   -.1    .2   -.1    .2   -.1
10081  4  -888.0-888.0   6.9   1.0   1.0   -.7   1.0    .9   1.5
10081  4  -888.0-888.0   -.8   -.6   -.6   -.7   -.7   -.7   -.6
10081  5  -888.0-888.0   1.3    .8   1.0   1.0   1.0   1.0   1.1
10081  5  -888.0-888.0   2.4    .9   1.0   1.3   1.2   1.3   1.1
10081  6  -888.0-883.0    .3    .5    .3-999.0    .2-999.0-999.0
10081  6  -888.0-888.0   1.4    .3   1.5    .7    .9   1.8   1.1


10142   317.    5.44   12.3  14:30  16:20  2737   409 3850   575
10142  1     198.0-883.0  11.0  23.0   9.0  12.0  12.0   3.0   6.0
10142  1      19.0-888.0  19.0   3.0   9.0   6.0  26.0  18.0  19.0
10142  2    -999.0-888.0   1.5   1.3   1.1   1.2   1.2   1.3    .9
10142  2        .2-888.0-999.0-999.0-999.0    .3    .2    .4    .2
10142  3       -.1-888.0    .4    .3    .2    .2    .4    .5    .4
10142  3       -.1-888.0   -.1   -.1   -.1   -.1   -.1   -.1   -.1
10142  4       -.8-888.0   1.1   5.0   2.9   2.8    .9   2.8   1.9
10142  4       -.8-888.0   -.7   -.7   -.8   -.8   -.9   -.9   1.2
10142  5        .5-888.0    .4   1.1    .6    .6    .5    .4    .5
10142  5        .4-888.0    .4    .5    .6    .5    .6    .7    .7
10142  6    -999.0-888.0-999.0-999.0-999.0-999.0-999.0-999.0-999.0
10142  6    -999.0-888.0-999.0-999.0-999.0-999.0    .3-999.0-999.0


10151   239.    1.53    8.0   7:20   9: 0  4548   680 2381   356
10151  1     223.0-888.0  66.0  54.0  27.0  42.0  32.0  36.0  21.0
10151  1      18.0-888.0  33.0  18.0   9.0  22.0  22.0  27.0  12.0
10151  2    -999.0-888.0   5.2-999.0   6.3   5.2   5.4   4.9   5.1
10151  2    -999.0-888.0-999.0-999.0    .5-999.0-999.0    .6    .6
10151  3        .7-888.0   1.6-999.0   1.8   1.7   1.7   2.2   1.8
10151  3       -.1-888.0   -.1   -.1   -.1   -.1   -.1   -.1    .1
10151  4       -.9-888.0  10.0-999.0   1.8   2.7   2.4   2.4   2.7
10151  4        .9-888.0   1.0   1.0   -.9   1.0    .9   -.8    .9
10151  5        .9-888.0   1.8-999.0-999.0    .8    .7    .9    .7
10151  5        .4-888.0   1.2    .5    .8   1.5   1.1   1.7   2.6
10151  6    -999.0-888.0    .5-999.0-999.0    .5    .7    .5    .6
10151  6        .5-888.0-999.0    .2    .3-999.0    .4-999.0    .3
```

```
10181    333.  4.74    7.8 14:30 17: 0  2712  405 3987  596
10181  1 -888.0  16.0  26.0  41.0  19.0   5.0-999.0  17.0-888.0
10181  1 -888.0  16.0  29.0  25.0  22.0  19.0  11.0   6.0-888.0
10181  2 -888.0   1.7-999.0   1.4   1.5   1.8    .9   1.3-888.0
10181  2 -888.0    .4    .9-999.0-999.0    .4    .2    .3-888.0
10181  3 -888.0    .6    .5    .5    .5    .6    .6    .5-888.0
10181  3 -888.0   -.1   -.1   -.1   -.1    .1   -.1   -.1-888.0
10181  4 -888.0  -1.0    .8   5.3   2.2   2.5   2.3   2.0-888.0
10181  4 -888.0  -1.0   -.7  -1.0   1.3   1.0  -1.2   1.3-888.0
10181  5 -888.0    .6    .7    .9    .4   1.4    .6    .5-888.0
10181  5 -888.0    .5    .7    .5    .7    .6    .5    .5-888.0
10181  6 -888.0    .2    .2    .2-999.0    .2-999.0    .2-888.0
10181  6 -888.0    .3-999.0-999.0-999.0    .3-999.0    .2-888.0


10191     92.  1.10    5.2  8:50 11:30  2915  436 1929  288
10191  1 -888.0  32.0  48.0  24.0  20.0  16.0  20.0  19.0-888.0
10191  1 -888.0  15.0  13.0  12.0  10.0  12.0  10.0  10.0-888.0
10191  2 -888.0   1.8   1.8    .3   1.9   1.6   2.2   2.2-888.0
10191  2 -888.0-999.0-999.0    .4    .5    .2-999.0-999.0-888.0
10191  3 -888.0    .6    .7    .8    .6    .5    .8    .7-888.0
10191  3 -888.0   -.1   -.1   -.1   -.1   -.1   -.1   -.1-888.0
10191  4 -888.0   2.9   5.0   5.3   1.9   -.9   1.4   1.2-888.0
10191  4 -888.0    .9   -.9   -.8   -.9   -.6   1.3   -.5-888.0
10191  5 -888.0    .6   1.0    .6    .4    .6    .5    .5-888.0
10191  5 -888.0    .3    .4    .5    .6    .3    .3    .4-888.0
10191  6 -888.0    .1    .3    .2-999.0    .1    .2    .2-888.0
10191  6 -888.0    .2-999.0    .2-999.0    .1    .2-999.0-888.0


10192    210.  1.73    7.3 12:50 15:20  2376  355 2680  400
10192  1   33.0  45.0-999.0  20.0   8.0  13.0  14.0-888.0-888.0
10192  1   30.0  31.0  23.0  20.0  12.0  29.0  19.0-888.0-888.0
10192  2    1.7   1.8   1.7   1.4   1.5   1.8   1.4-888.0-888.0
10192  2 -999.0-999.0    .3    .2    .2    .4-999.0-888.0-888.0
10192  3     .6    .7    .6    .6    .6    .7    .5-888.0-888.0
10192  3    -.1   -.1    .1   -.1    .1   -.1   -.1-888.0-888.0
10192  4    4.5   5.3   6.7    .9   -.8   1.0    .9-888.0-888.0
10192  4    1.1   1.2   1.1   -.7    .8  -1.0    .9-888.0-888.0
10192  5     .6    .7   1.0    .3    .6    .4    .4-888.0-888.0
10192  5     .7    .6    .6    .4    .4    .6    .6-888.0-888.0
10192  6     .2    .4    .3    .3    .3    .3    .2-888.0-888.0
10192  6 -999.0-999.0-999.0    .2-999.0-999.0-999.0-888.0-888.0
```

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```
10201   40.   1.92   10.2   9:10  11:20  2802   419 1916   286
10201  1  37.0  42.0  63.0  43.0  24.0  20.0  19.0-888.0-888.0
10201  1  16.0  12.0  21.0  20.0  18.0   9.0   8.0-888.0-888.0
10201  2   3.1   3.1   3.5   3.1   2.8   3.1   3.2-888.0-888.0
10201  2-999.0    .4    .5-999.0    .4    .4    .5-888.0-888.0
10201  3   1.3   1.2   1.4   1.2   1.0   1.2   1.3-888.0-888.0
10201  3    .2    .2    .1    .2    .2    .1    .1-888.0-888.0
10201  4   5.2   7.1   9.1   4.8   3.0   1.7   1.3-888.0-888.0
10201  4    .9   -.9   -.7   -.8   -.6   -.9   -.8-888.0-888.0
10201  5   1.0   1.0   1.3   1.0    .8    .7    .5-888.0-888.0
10201  5   1.3   1.4   1.1   1.4   1.2   1.3   1.3-888.0-888.0
10201  6    .2-999.0    .4    .2    .2-999.0    .3-888.0-888.0
10201  6    .6    .5    .5-999.0    .6    .6    .8-888.0-888.0


10211  303.   6.81   11.4   9: 0  11:20  2868   428 1921   287
10211  1  38.0  27.0  25.0  33.0  18.0  22.0  22.0-888.0-888.0
10211  1   4.0  17.0  13.0-999.0  11.0  11.0  11.0-888.0-888.0
10211  2   6.0   4.9   5.1   4.8   4.6   4.6   5.3-888.0-888.0
10211  2-999.0-999.0-999.0-999.0-999.0-999.0    .4-888.0-888.0
10211  3   2.1   2.1   2.0   1.9   1.9   1.9   2.1-888.0-888.0
10211  3    .1    .1   -.1   -.1   -.1   -.1    .1-888.0-888.0
10211  4   -.8   -.7   1.5   3.5   1.5   1.9   1.4-888.0-888.0
10211  4   -.8   -.7   -.8   -.8   -.8   -.8   -.8-888.0-888.0
10211  5    .5   1.0    .7    .4   1.3    .6    .7-888.0-888.0
10211  5    .3    .4    .6    .3    .4    .4    .5-888.0-888.0
10211  6    .1    .2-999.0    .1-999.0-999.0    .2-888.0-888.0
10211  6-999.0-999.0-999.0    .2-999.0-999.0-999.0-888.0-888.0


10212  303.   5.66   11.7  13:30  15:50  2554   382 3139   459
10212  1  33.0  19.0  43.0  39.0  33.0  40.0  17.0-888.0-888.0
10212  1  19.0   7.0  22.0  14.0  12.0  10.0-999.0-888.0-888.0
10212  2   7.8    .7   6.6   7.3   6.8   7.1   7.0-888.0-888.0
10212  2    .4-999.0    .5-999.0-999.0    .4-999.0-888.0-888.0
10212  3   2.7    .5   2.7   2.4   2.4   2.5   2.7-888.0-888.0
10212  3    .2   -.1    .2   -.1   -.1   -.1    .1-888.0-888.0
10212  4  -1.0    .9   4.8   4.9   2.5   3.0   2.7-888.0-888.0
10212  4   -.6   -.9   -.9   1.2   1.0   1.0   -.7-888.0-888.0
10212  5    .3    .4    .5    .6    .7    .4    .8-888.0-888.0
10212  5    .3    .3    .7    .5    .5    .5    .8-888.0-888.0
10212  6-999.0-999.0    .2    .2    .1-999.0    .2-888.0-888.0
10212  6-999.0-999.0-999.0-999.0-999.0-999.0-999.0-888.0-888.0
```

```
10221   293.  5.83   6.3  8:50 11:30  2915  436 1929  288
10221 1   37.0  33.0  38.0  43.0  26.0  37.0  38.0-888.0-888.0
10221 1   25.0  15.0  14.0  18.0-999.0  23.0  14.0-888.0-888.0
10221 2    6.3   6.1   5.9   6.4   6.2   6.7   6.7-888.0-888.0
10221 2 -999.0-999.0-999.0-999.0    .4-999.0-999.0-888.0-888.0
10221 3    2.2   1.8   2.1   2.1   2.2   2.3   2.2-888.0-888.0
10221 3     .1   -.1    .2    .2    .1   -.1    .1-888.0-888.0
10221 4    -.9  -1.0   4.3   5.9   4.5   3.2   2.1-888.0-888.0
10221 4    -.9  -1.0   -.8   -.8   1.4   -.9   -.9-888.0-888.0
10221 5    1.0   1.0    .9    .8    .8    .7    .7-888.0-888.0
10221 5     .9   1.0    .8    .6    .4    .5    .9-888.0-888.0
10221 6 -999.0   1.0    .6    .6    .4    .6    .5-888.0-888.0
10221 6 -999.0    .2-999.0-999.0    .3-999.0    .1-888.0-888.0


11092   254.  1.85   3.4 14:20 16:30  2736  409 3820  571
11092 1   43.0  49.0  48.0  30.0  23.0  19.0  34.0  42.0-888.0
11092 1   80.0  14.0  96.0  35.0  49.0  19.0  16.0-999.0-888.0
11092 2 -999.0   4.1   3.7   3.6   3.1   3.5   1.6    .7-888.0
11092 2   21.5-999.0  17.9   7.1   9.2   2.8-999.0-999.0-888.0
11092 3    1.0   1.2   1.3   1.2   1.1   1.2   1.4    .5-888.0
11092 3    6.3    .1   4.3   2.7   2.7   1.1    .2   1.0-888.0
11092 4    3.3   7.1   7.3  -1.0  -1.0    .9   -.9  -1.0-888.0
11092 4    1.9   -.6   2.7   1.3   -.7    .6    .6   2.0-888.0
11092 5 -999.0   1.2   1.7   1.0    .7    .5    .5    .6-888.0
11092 5     .7-999.0   1.5    .6    .5    .6    .6    .7-888.0
11092 6 -999.0    .9-999.0    .8-999.0-999.0    .7-999.0-888.0
11092 6     .9-999.0   1.5-999.0-999.0-999.0    .3-999.0-888.0


11101   270.  1.06   1.1  8:10  9:40  3845  574 2255  337
11101 1   81.0  84.0  92.0  61.0  69.0  58.0  50.0  94.0-888.0
11101 1   49.0  68.0  64.0 199.0  53.0 125.0  54.0  49.0-888.0
11101 2    8.2   7.7   9.0   6.6   7.1   7.5   7.2   4.2-888.0
11101 2 -999.0   4.4  18.8  29.9-999.0  18.3   9.1  17.4-888.0
11101 3    2.8   2.2   2.1   1.8   1.9   2.3   2.1   1.2-888.0
11101 3    3.2   1.6   5.1   7.4   5.1   5.1   3.2   5.0-888.0
11101 4    4.8   5.3   8.1   2.3   2.9   3.1   1.7  -1.6-888.0
11101 4    7.3   7.8   1.2  10.6  -1.0   1.7   3.8   1.1-888.0
11101 5    4.7   4.7   6.1   3.4   2.9   3.7   3.3   2.7-888.0
11101 5    1.5   1.0   1.2   2.5   1.0    .8   2.4   1.1-888.0
11101 6    2.4   2.2   2.7   1.8   1.8   2.2   2.0   1.9-888.0
11101 6    1.3-999.0   2.3   2.4-999.0-999.0   2.6   2.2-888.0
```

```
12011    305.    .94   -4.6   8:30  12:10   2870   429 1992   298
12011  1   60.0  34.0  55.0  60.0  77.0  46.0  28.0  46.0-888.0
12011  1   41.0  10.0  23.0  28.0  29.0  29.0  18.0  32.0-888.0
12011  2    5.9   5.5   6.3   5.5   6.1   5.1-999.0   4.9-888.0
12011  2 -999.0-999.0-999.0-999.0    .4-999.0    .6-999.0-888.0
12011  3    1.6   1.6   1.7    .8   1.5   1.5   1.6   1.5-888.0
12011  3     .1   -.1    .1    .6   -.1   -.1   -.1   -.1-888.0
12011  4    2.3   2.9   4.5   5.0   3.1   1.7   2.0   2.2-888.0
12011  4     .7   -.4   1.0   -.4    .8    .4   -.4   -.4-888.0
12011  5     .5    .5    .9    .6    .6    .5-999.0    .4-888.0
12011  5     .4    .4    .6    .3    .4    .3    .3    .5-888.0
12011  6     .8    .8    .4    .3    .6    .6-999.0    .5-888.0
12011  6     .6-999.0    .5    .4    .5    .4    .4    .5-888.0


12012    226.   3.14   -3.1  13:50  16:10   2664   398 3453   516
12012  1   61.0  56.0  65.0  42.0   2.0  27.0  43.0  29.0-888.0
12012  1   79.0  38.0  37.0  23.0  16.0  52.0  30.0  33.0-888.0
12012  2    5.1   5.6   6.0   5.0   4.8-999.0-999.0   5.2-888.0
12012  2 -999.0-999.0-999.0-999.0-999.0-999.0-999.0-999.0-888.0
12012  3     .2   1.5   1.6   1.5   1.4   1.4   1.4   1.6-888.0
12012  3    -.1   -.1   -.1   -.1   -.1   -.1   -.1   -.1-888.0
12012  4    3.2   3.6   6.6   -.7   -.7   -.6   -.7   -.6-888.0
12012  4     .9   -.6   1.0   -.7   -.7   -.6   -.7   -.6-888.0
12012  5     .9    .8   1.2    .6    .7    .7    .4    .5-888.0
12012  5    4.2    .6    .7    .6    .5    .7    .7    .5-888.0
12012  6     .8    .5    .4    .4    .6    .7-999.0    .3-888.0
12012  6     .4-999.0    .3-999.0    .4    .5-999.0-999.0-888.0


12092    327.   5.74   -3.1  13:20  15:30   2488   372 2928   438
12092  1   11.0   2.0  29.0  23.0   7.0   9.0   9.0   8.0-888.0
12092  1   13.0-999.0  14.0  19.0   2.0  11.0   2.0   8.0-888.0
12092  2    2.3   2.3   2.4   2.8-999.0   2.3   2.2   2.3-888.0
12092  2 -999.0-999.0-999.0-999.0-999.0-999.0    .4-999.0-888.0
12092  3     .8    .8    .8    .8    .8    .8    .8    .8-888.0
12092  3     .1   -.1   -.1   -.1   -.1   -.1   -.1   -.1-888.0
12092  4    -.7   -.9   -.9   4.3   1.7   2.1   1.7   2.2-888.0
12092  4    -.7   -.9   -.9   -.8   -.8   -.9   -.9   -.7-888.0
12092  5    1.4   1.0   1.0   1.4   1.8   1.1   1.0   1.9-888.0
12092  5    2.1    .9    .9   1.7   1.6   1.6   1.0   1.5-888.0
12092  6     .2    .1    .2-999.0-999.0-999.0-999.0    .2-888.0
12092  6 -999.0-999.0-999.0-999.0-999.0-999.0-999.0-999.0-888.0
```

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12141    244.   3.68    -7.6   8:50   11:10   2987   446 1941   290
12141  1   37.0  36.0  61.0  11.0  24.0  15.0  22.0-999.0-888.0
12141  1   11.0  25.0  16.0-999.0-999.0    .0-999.0   6.0-888.0
12141  2    6.2   5.0   5.6   5.1   5.3   5.3   5.5   5.9-888.0
12141  2 -999.0-999.0-999.0-999.0-999.0-999.0-999.0-999.0-888.0
12141  3    2.0   1.8   1.8   2.0   1.8   1.9   2.0   2.0-888.0
12141  3     .2   -.1    .2    .1    .2    .1    .1    .2-888.0
12141  4    4.5   3.3   6.9   1.4   1.6   -.7   1.3   1.2-888.0
12141  4    1.3   -.7    .9   -.7   -.7   -.7   -.7   -.7-888.0
12141  5    1.3   1.3   2.0   1.0    .8   1.0    .8   1.1-888.0
12141  5     .6    .5    .7    .4    .5    .6    .5    .6-888.0
12141  6     .9    .7    .3    .5    .6    .5    .4    .5-888.0
12141  6 -999.0-999.0-999.0-999.0-999.0    .2-999.0-999.0-888.0


12142    238.   5.42    -2.0  13:50   16:10   2664   398 3453   516
12142  1   25.0  27.0  76.0  21.0  14.0  23.0-999.0   9.0-888.0
12142  1   11.0    .0  18.0-999.0   5.0  12.0   5.0   7.0-888.0
12142  2    3.7   3.5-999.0   3.8   3.1   3.6   3.0   3.8-888.0
12142  2 -999.0-999.0-999.0-999.0-999.0-999.0-999.0-999.0-888.0
12142  3    1.2   1.3   1.4   1.4   1.3   1.2   1.4   1.3-888.0
12142  3    -.1   -.1   -.1    .1    .1   -.1   -.1   -.1-888.0
12142  4    2.4   3.6   5.5   -.8   -.8   1.3   1.1   -.8-888.0
12142  4     .9   -.7   1.1   -.8   -.8   -.7    .8   -.8-888.0
12142  5     .5   1.0   1.3    .6    .7    .6    .7    .5-888.0
12142  5     .6    .9   1.8    .5    .7    .8    .8    .7-888.0
12142  6 -999.0    .5    .4    .1-999.0-999.0    .3-999.0-888.0
12142  6     .2-999.0-999.0-999.0-999.0-999.0-999.0-999.0-888.0


12151    270.   3.44     4.0   8:50   11:10   2987   446 1941   290
12151  1   53.0  48.0  74.0  57.0  42.0  47.0  34.0  41.0-888.0
12151  1   15.0   5.0  18.0   9.0  11.0   9.0  14.0  45.0-888.0
12151  2    8.3   8.9   9.0   8.5   8.1   1.5   8.8   7.2-888.0
12151  2 -999.0-999.0-999.0-999.0-999.0-999.0-999.0-999.0-888.0
12151  3    2.9   2.8   2.7   2.8   2.5   2.9   2.8   2.7-888.0
12151  3     .2   -.1    .3    .7    .2    .2    .2    .2-888.0
12151  4    4.1   4.9   7.3   2.7   2.0   1.9   1.5   1.6-888.0
12151  4    -.6   -.6   -.6   -.6   -.6   -.1   -.6   -.6-888.0
12151  5    1.6   1.9   2.4   2.2   1.7    .4   1.9   1.8-888.0
12151  5     .7    .5   1.0    .2    .8    .2    .7    .9-888.0
12151  6    1.0   1.3   1.2   1.2    .9    .2   1.1   1.1-888.0
12151  6 -999.0-999.0    .3-999.0    .3-999.0-999.0-999.0-888.0
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12152   269.   1.44    6.5  13:50  16:10  2664   398 3453   516
12152  1     60.0  66.0  60.0  57.0  48.0  56.0  39.0  54.0-888.0
12152  1     35.0    .0  26.0   6.0   2.0  30.0  20.0  28.0-888.0
12152  2      9.1   9.2   9.5   8.9   8.0   7.6   8.5   8.7-888.0
12152  2   -999.0-999.0-999.0    .5-999.0-999.0-999.0-999.0-888.0
12152  3      3.2   2.9   3.1   2.7   2.6   2.8   2.7   2.7-888.0
12152  3       .4   -.1    .5    .2    .3    .3    .3    .3-888.0
12152  4      4.2   5.8   7.9   5.5   3.5   4.3   3.5   1.9-888.0
12152  4      -.7   -.7   1.8   -.7   -.7   1.3    .9   -.7-888.0
12152  5      1.2   1.8   2.0   1.7   1.1   1.3   1.2   1.2-888.0
12152  5      1.3    .6   1.4    .6   1.2   1.2   1.4   1.3-888.0
12152  6      1.1   1.9    .7   1.2    .7   1.1   1.0    .9-888.0
12152  6       .5-999.0    .6-999.0    .4    .5    .6    .5-888.0


12161    55.   3.37    3.4   8:50  11:10  2987   446 1941   290
12161  1     31.0  18.0  23.0  53.0  41.0  45.0  34.0  38.0-888.0
12161  1      9.0-999.0    .0   2.0  21.0   7.0  43.0  16.0-888.0
12161  2      7.8   7.7   7.7   7.1   6.2   7.7   7.0   6.6-888.0
12161  2   -999.0-999.0    .7    .6-999.0-999.0    .6-999.0-888.0
12161  3      2.8   2.3  -2.3   2.7   2.3   2.4   2.3   2.5-888.0
12161  3       .2   -.1   -.1    .1    .2   -.1   -.1    .2-888.0
12161  4      2.1   1.2    .9   7.0   3.6   4.4   2.9   3.6-888.0
12161  4      -.7   -.8   -.8   -.7    .9   -.8    .1   -.7-888.0
12161  5       .3   1.0    .9   1.4    .6   1.0   1.0    .8-888.0
12161  5       .4    .7   1.0    .6    .6   1.0    .9    .9-888.0
12161  6       .7   1.0    .7   1.3    .8    .8    .8    .7-888.0
12161  6       .6    .2    .8    .3-999.0    .8    .8    .5-888.0


12162    56.   1.84    4.1  13:50  16:10  2664   398 3453   516
12162  1     36.0  36.0  27.0  60.0  43.0  55.0  44.0  32.0-888.0
12162  1     14.0-999.0  14.0  11.0  20.0  16.0  18.0  11.0-888.0
12162  2      7.2   8.5   8.1   8.5   8.2   8.8   8.0   8.0-888.0
12162  2       .7    .2    .7    .5    .8-999.0    .7    .8-888.0
12162  3      2.9   2.7   2.5   2.8   2.5   2.5   2.6   2.4-888.0
12162  3       .2   -.1    .1    .1    .3   -.1   -.1    .2-888.0
12162  4      1.3   1.5   2.4   7.5   4.1   4.0   3.7   3.3-888.0
12162  4      1.3   -.8   1.0    .8   1.3   -.8   -.8    .8-888.0
12162  5       .8    .8   1.0   1.5   1.1   1.2    .9   1.1-888.0
12162  5       .7    .5    .8    .5    .7    .7    .6    .6-888.0
12162  6       .7   1.5    .7   1.2    .4    .5    .8    .4-888.0
12162  6      1.5-999.0   1.5    .3   1.7   1.5   1.4   1.6-888.0
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12171    300.   4.10    2.2   7:50  10:10  3821   571 2172   324
12171  1   33.0  33.0  40.0  51.0  36.0  39.0  34.0  34.0-888.0
12171  1    2.0-999.0-999.0-999.0  17.0-999.0-999.0   7.0-888.0
12171  2    9.8   9.6   9.8   9.8   9.8  10.5  10.2  10.2-888.0
12171  2     .8    .1    .8    .5    .7    .2    .7-999.0-888.0
12171  3    3.2   3.2   3.2   3.0   3.2   3.3   3.3   3.3-888.0
12171  3     .1  -1.0   -.1   -.1    .1   -.1    .1   -.1-888.0
12171  4    -.8   1.2   1.7   5.3   2.6   3.1   2.8   3.1-888.0
12171  4    -.8  -1.0  -1.0   -.8   -.8  -1.0   1.2   -.8-888.0
12171  5     .4    .7    .6   1.1    .7    .7    .5   1.1-888.0
12171  5     .6    .4    .5    .7    .6    .9    .5    .9-888.0
12171  6     .4    .6    .5    .3    .4    .1    .6   1.1-888.0
12171  6     .4-999.0    .3    .1    .4   1.0    .2    .3-888.0


12201    225.   4.97    7.3  15:30  17:10  2717   406 4397   657
12201  1   18.0  29.0  29.0   5.0   8.0  18.0    .0  13.0-888.0
12201  1   21.0-999.0  18.0-999.0   6.0-999.0   7.0   5.0-888.0
12201  2    5.3   5.1    .9   4.4   4.8   4.9   5.0   4.4-888.0
12201  2     .8    .4    .1-999.0    .7-999.0-999.0    .4-888.0
12201  3    1.7   1.6   1.6   1.7   1.4   1.5   1.5   1.5-888.0
12201  3     .1   -.1   -.1   -.1   -.1   -.1   -.1   -.1-888.0
12201  4    1.6   -.9   2.4   -.8   -.9   -.8   -.8   -.8-888.0
12201  4    -.8   -.9   -.8   -.8   -.9   -.8   -.8   -.8-888.0
12201  5    1.1   1.5   1.3   1.3   1.0    .9   1.0    .9-888.0
12201  5    1.2    .6   1.6    .5   1.2   1.5   1.7   1.3-888.0
12201  6    1.4   1.7   1.1   1.2   1.4   1.4   1.3   1.1-888.0
12201  6    1.0    .3    .8    .2   1.1    .9    .8    .9-888.0


12211    312.   8.22   -3.4   8:50  11:10  2987   446 1941   290
12211  1   33.0   4.0   6.0  12.0  21.0   6.0  12.0   2.0-888.0
12211  1   29.0-999.0   9.0-999.0  32.0   6.0-999.0  80.0-888.0
12211  2    2.5   2.5   2.6   2.5   2.2   2.7   2.8   3.3-888.0
12211  2 -999.0-999.0    .4-999.0-999.0-999.0    .2-999.0-888.0
12211  3     .9    .8    .8   1.0    .9    .9    .8    .9-888.0
12211  3    -.1   -.1   -.1   -.1   -.1   -.1   -.1   -.1-888.0
12211  4    -.7   -.8   -.8   2.1    .7   1.6   -.8   1.6-888.0
12211  4    -.7   -.8   -.8   -.7   -.7   -.8   -.8   -.7-888.0
12211  5     .3-999.0-999.0    .8    .4    .6-999.0   1.0-888.0
12211  5 -999.0-999.0    .4    .4    .5    .5    .4    .5-888.0
12211  6 -999.0-999.0-999.0-999.0-999.0-999.0-999.0    .2-888.0
12211  6 -999.0-999.0-999.0-999.0-999.0-999.0-999.0-999.0-888.0
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12221   298.   4.85   -5.0   8:50  11:10  2987  446 1941  290
12221  1  -999.0   7.0   9.0  21.0   5.0  20.0   7.0   2.0-888.0
12221  1    30.0-999.0  21.0   2.0   7.0  11.0    .0   7.0-888.0
12221  2      .8   2.0   2.5   2.4   2.4   2.6   2.1   3.3-888.0
12221  2  -999.0-999.0-999.0-999.0-999.0-999.0-999.0-999.0-888.0
12221  3      .7    .8    .8    .8    .7    .8    .8    .7-888.0
12221  3     -.1   -.1   -.1   -.1   -.1   -.1   -.1   -.1-888.0
12221  4     -.8   1.2   2.0   3.4   2.2   2.9   2.6   1.4-888.0
12221  4     -.8   -.8   1.0   -.9   -.9   -.8   -.8   -.8-888.0
12221  5      .8    .7    .8   1.2    .7    .7    .8    .7-888.0
12221  5      .9    .7    .7    .8   1.5    .8-999.0    .8-888.0
12221  6  -999.0-999.0-999.0-999.0-999.0-999.0-999.0-999.0-888.0
12221  6  -999.0-999.0-999.0-999.0-999.0-999.0-999.0-999.0-888.0


12231   256.   3.70    2.1  11:50  14:50  2254  337 2304  344
12231  1    40.0  39.0  51.0  26.0  26.0  30.0  21.0-888.0-888.0
12231  1     8.0  15.0  22.0   9.0  12.0  12.0  12.0-888.0-888.0
12231  2     5.3   4.4   6.6-999.0   4.7   4.6   5.1-888.0-888.0
12231  2  -999.0-999.0-999.0-999.0    .3-999.0-999.0-888.0-888.0
12231  3     1.6   1.5   1.5   1.5   1.6   1.7   1.6-888.0-888.0
12231  3     -.1   -.1   -.1   -.1   -.1   -.1   -.1-888.0-888.0
12231  4     3.9   5.1   6.6   -.9   1.2   1.3   -.8-888.0-888.0
12231  4    -1.0   -.9   1.2   -.9   -.9   -.8   -.8-888.0-888.0
12231  5     1.5   1.1   1.8   1.3    .7    .9   1.0-888.0-888.0
12231  5      .9    .9   1.2   1.3    .7   1.0    .8-888.0-888.0
12231  6     1.1    .4    .3    .8    .6    .6    .7-888.0-888.0
12231  6  -999.0-999.0    .5-999.0    .4-999.0-999.0-888.0-888.0


12271   321.   6.69   -6.5  13:50  16:10  2664  398 3453  516
12271  1  -999.0   5.0    .0-999.0    .0  12.0  20.0-888.0-888.0
12271  1  -999.0-999.0   5.0   6.0-999.0   6.0-999.0-888.0-888.0
12271  2      .6   1.4-999.0    .9   2.3    .4   2.1-888.0-888.0
12271  2  -999.0-999.0-999.0-999.0-999.0-999.0-999.0-888.0-888.0
12271  3      .5    .6    .4    .4    .5    .5    .6-888.0-888.0
12271  3     -.1   -.1   -.1   -.1   -.1   -.1   -.1-888.0-888.0
12271  4     -.6   -.6    .8   2.7   1.0   1.5   1.5-888.0-888.0
12271  4     -.6   -.6   -.6   -.5    .5    .5    .5-888.0-888.0
12271  5      .8    .9-999.0   1.0    .6    .7    .6-888.0-888.0
12271  5      .7    .8    .6   1.6    .8   1.4    .8-888.0-888.0
12271  6  -999.0-999.0-999.0-999.0    .3-999.0-999.0-888.0-888.0
12271  6  -999.0-999.0    .2-999.0    .7-999.0-999.0-888.0-888.0
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12281    68.  2.50  -4.0 14: 0 15:40  2646   395 3283   491
12281  1   4.0   9.0  17.0  34.0  20.0  18.0  30.0  18.0-888.0
12281  1   2.0   4.0   6.0  21.0  25.0  16.0   4.0  13.0-888.0
12281  2   5.1   4.4   3.9-999.0   3.7   4.6-999.0   4.4-888.0
12281  2-999.0-999.0-999.0-999.0-999.0-999.0-999.0-999.0-888.0
12281  3   1.4   1.4   1.1   1.3   1.2   1.4   1.4   1.3-888.0
12281  3   -.1   -.1   -.1   -.1   -.1   -.1   -.1   -.1-888.0
12281  4   -.5   -.6   -.6   2.3   1.6   1.6    .8   1.3-888.0
12281  4   -.5   -.6   -.6   -.5   -.6   -.5   -.5   -.3-888.0
12281  5   1.0   1.4    .6   5.5   1.1   1.8   1.0    .8-888.0
12281  5    .7    .6    .9   9.5   5.9   8.1   3.8   5.3-888.0
12281  6-999.0    .6    .2-999.0    .3    .5    .3    .4-888.0
12281  6-999.0-999.0-999.0-999.0-999.0-999.0-999.0-999.0-888.0


 1041    66.   .71  -1.8  9:20 11:40  2675   400 1885   282
 1041  1  61.0  57.0  51.0  85.0  74.0  43.0  61.0-999.0-888.0
 1041  1-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
 1041  2  13.8  16.2  16.2  13.9  14.3  14.2  14.1-999.0-888.0
 1041  2-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
 1041  3   4.2   4.2   4.0   4.1   4.3   4.0   3.9-999.0-888.0
 1041  3-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
 1041  4   1.8   3.6   3.5   7.8   6.1   4.7   3.9-999.0-888.0
 1041  4-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
 1041  5    .9   1.6   2.2   1.8   1.4   1.3   1.0-999.0-888.0
 1041  5-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
 1041  6-999.0    .8   1.4    .2    .1    .1   1.4    .7-888.0
 1041  6-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


 1051    21.  3.31  -3.6  8:50 11:10  2987   446 1941   290
 1051  1   4.0  24.0  15.0  44.0  26.0  32.0-999.0-888.0-888.0
 1051  1-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
 1051  2   6.1   8.3   6.3   8.9   8.1   5.9   5.6-888.0-888.0
 1051  2-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
 1051  3   2.2   2.3   2.2   2.3   2.1   2.2   2.3-888.0-888.0
 1051  3-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
 1051  4   -.7   -.8   -.8   5.1   2.2   2.5   1.5-888.0-888.0
 1051  4-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
 1051  5   1.5   1.7    .7   2.1   1.5   1.0    .6-888.0-888.0
 1051  5-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
 1051  6    .2    .9-999.0    .3    .3-999.0    .4-888.0-888.0
 1051  6-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
```

```
1122   298.   6.20   -8.8  11:20  13:40  2133  319 2031   303
1122  1   18.0  11.0-999.0  28.0   2.0  17.0  16.0  13.0-888.0
1122  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1122  2    6.2   6.2   6.1   6.5   6.0   6.3   5.9   5.3-888.0
1122  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1122  3    2.0   2.1   2.1   2.2   1.9   2.1   2.0   2.1-888.0
1122  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1122  4    -.9   -.9   -.9   4.3   1.2   2.1   2.1   1.2-888.0
1122  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1122  5     .9   1.1   2.2   3.5   1.1   1.5   1.4   1.3-888.0
1122  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1122  6 -999.0-999.0    .3    .3-999.0-999.0-999.0-999.0-888.0
1122  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


1131   311.   1.45  -11.8   7:20   9:40  4253  636 2281   341
1131  1   20.0-999.0  44.0  50.0  30.0  38.0  26.0  40.0-888.0
1131  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1131  2    6.7   6.8   7.3   7.8   6.7   7.2   6.2   7.8-888.0
1131  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1131  3    2.1   2.1   2.3   2.1   2.0   2.3   1.7   2.4-888.0
1131  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1131  4    -.8   -.9   1.8   6.0   3.2   3.4   2.1   3.1-888.0
1131  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1131  5    1.2   7.0   1.9   3.8   2.3   2.6   2.1   2.2-888.0
1131  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1131  6     .8   1.2   1.7   2.8   1.7   2.3   1.6   2.4-888.0
1131  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


1132   314.   2.22   -8.8  10:20  12:40  2284  341 1914   286
1132  1   25.0   2.0  21.0  46.0  44.0  13.0  23.0  33.0-888.0
1132  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1132  2    6.3   7.4   6.9   6.8   6.5   6.3   5.7   7.6-888.0
1132  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1132  3    2.0   2.1   2.2   2.2   2.1   2.1   1.8   2.3-888.0
1132  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1132  4    1.1   1.2   2.1   4.9   3.1   2.6   1.8   2.1-888.0
1132  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1132  5    1.4   1.8   1.4   2.8   1.9   1.5   1.3   1.8-888.0
1132  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1132  6     .6   2.2   1.3   1.2   1.2    .8    .6    .6-888.0
1132  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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1133    309.   2.90    -7.1  13:10  15:20  2434   364 2754  412
1133  1    12.0  16.0   8.0  31.0  14.0  24.0  22.0  22.0-888.0
1133  1  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1133  2     5.6   4.9   6.0   6.8   6.0   6.7   5.3   7.0-888.0
1133  2  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1133  3     1.8   1.8   1.9   2.0   2.0   1.8   1.7   2.1-888.0
1133  3  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1133  4     -.8   -.8   -.8   5.6   2.3   3.5   1.3   2.5-888.0
1133  4  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1133  5     1.2   1.6   1.4   2.5   1.9   1.6   1.6   1.5-888.0
1133  5  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1133  6  -999.0    .4    .4    .4    .3   1.4    .4    .4-888.0
1133  6  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


1141    254.   3.69    -3.2   7:20   9:40  4253   636 2281  341
1141  1    37.0  49.0  60.0  27.0  36.0-999.0  16.0  65.0-888.0
1141  1  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1141  2     7.3   7.9   7.8   8.7   7.0   7.7   7.3   9.4-888.0
1141  2  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1141  3     2.3   2.2   2.2   2.6   2.4   2.2   2.3   2.8-888.0
1141  3  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1141  4     4[illegible]   4.7   7.0   1.7   -.9   1.9   1.4   2.0-888.0
1141  4  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1141  5     3.6   4.7   4.6   4.7   4.0   4.4   2.9   4.8-888.0
1141  5  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1141  6     1.2   1.8   2.0   2.0   1.3   1.6   1.0   2.2-888.0
1141  6  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


1181    299.   6.32  -16.1    8:50  11:10  2987   446 1941  290
1181  1    26.0  30.0-999.0  66.0  41.0  40.0  21.0-888.0-888.0
1181  1  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1181  2     7.3   6.9   7.7   7.3   6.9   6.7   8.1-888.0-888.0
1181  2  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1181  3     2.1   2.1   2.5   2.1   2.1   2.3   2.3-888.0-888.0
1181  3  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1181  4      .9   -.6   1.0   2.1   2.1   2.3   2.1-888.0-888.0
1181  4  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1181  5     2.5   2.0   1.6  22.6   5.0   4.6   3.3-888.0-888.0
1181  5  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1181  6      .8    .9   1.2   1.1    .9   1.2   2.2-888.0-888.0
1181  6  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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1182   302.   4.99  -12.8  12:50  15:10  2350   351 2616   391
1182  1   17.0   8.0  21.0  52.0  27.0  22.0  24.0-888.0-888.0
1182  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1182  2    4.6   7.3   5.2   5.9   5.0   5.1   5.4-888.0-888.0
1182  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1182  3    1.4   1.6   1.7   1.9   1.6   1.7   1.7-888.0-888.0
1182  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1182  4    -.5    .6    .7   4.9   2.1   2.5   1.7-888.0-888.0
1182  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1182  5    1.8   3.0   2.1  18.0   3.5   4.0   3.0-888.0-888.0
1182  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1182  6     .5   2.0    .6    .9    .8    .8    .7-888.0-888.0
1182  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


1191   295.   3.16  -10.0   8:20  11:10  3181   475 2046   306
1191  1   28.0  31.0  39.0  74.0  25.0  50.0  33.0-888.0-888.0
1191  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1191  2    5.6   5.5   5.8   6.0   5.4   5.8   5.8-888.0-888.0
1191  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1191  3    1.6   1.7   1.6   1.8   1.7   1.8   1.7-888.0-888.0
1191  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1191  4    1.1   1.0   2.4   5.1   3.1   2.8   2.4-888.0-888.0
1191  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1191  5    1.2   3.7   3.4  19.9   4.0   4.2   3.9-888.0-888.0
1191  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1191  6     .9    .9   1.1   1.3   1.0   1.4   1.1-888.0-888.0
1191  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


1201   302.   5.31   -1.2   9:30  10:40  2855   427 1882   281
1201  1 -999.0-999.0-999.0-999.0-999.0-999.0-999.0-888.0-888.0
1201  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1201  2    4.3    .2   4.4   5.2   4.3   4.7   3.6-888.0-888.0
1201  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1201  3    1.6   -.1   1.7   1.9   1.5   1.8   1.4-888.0-888.0
1201  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1201  4     .9   -.5    .9   4.0   1.7   2.3    .6-888.0-888.0
1201  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1201  5     .9   1.6   2.3-999.0   4.1   2.6   1.8-888.0-888.0
1201  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1201  6 -999.0    .2    .2    .4    .1-999.0    .1-888.0-888.0
1201  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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1202    306.   5.05     .7  12:20   14:30   2211    330 2247   336
1202  1    7.0-999.0-999.0  29.0  16.0-888.0  15.0-888.0-888.0
1202  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1202  2    2.4   3.9   4.0   4.3   3.9-888.0   4.6-888.0-888.0
1202  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1202  3    1.5   1.4   1.4   1.5   1.4-888.0   1.7-888.0-888.0
1202  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1202  4    -.6   -.6   -.6   3.7   1.5-888.0   1.2-888.0-888.0
1202  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1202  5     .7    .8    .8   3.2   1.0-888.0   1.0-888.0-888.0
1202  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1202  6 -999.0-999.0-999.0    .2-999.0-888.0-999.0-888.0-888.0
1202  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


1261    298.   4.83   -1.2  13:20   15:40   2507    375 3006   449
1261  1   17.0  26.0  30.0  46.0  49.0  33.0  30.0-888.0-888.0
1261  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1261  2    6.0   7.6   6.0   7.0   6.6   6.8-999.0-888.0-888.0
1261  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1261  3    1.8   1.9   2.0   1.8   2.0   1.7   2.0-888.0-888.0
1261  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1261  4     .8   1.6   2.2   4.1   2.2   2.2   1.9-888.0-888.0
1261  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1261  5     .5    .8    .5   1.4    .6    .7-999.0-888.0-888.0
1261  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1261  6 -999.0    .4-999.0    .5    .2-999.0-999.0-888.0-888.0
1261  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


1271    284.   5.40    -.8   7:20    9:40   4253    636 2281   341
1271  1   27.0  45.0  40.0  53.0  31.0  36.0  40.0  29.0-888.0
1271  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1271  2    2.9   3.0   3.3   3.3   3.1   2.8   3.1   3.1-888.0
1271  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1271  3     .8    .9   1.1   1.1   2.9    .9   1.0    .8-888.0
1271  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1271  4    1.6   2.4   3.8   5.8   2.9   2.4   2.4   1.4-888.0
1271  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1271  5     .7   2.0   1.5   3.6   1.2   1.4   2.5   1.0-888.0
1271  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1271  6     .8    .9    .7   1.0    .7    .6    .8    .8-888.0
1271  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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1273    269.    5.99    -2.2  12:20   14:40   2246   336 2295   343
1273   1      14.0   21.0   28.0   16.0   12.0   17.0   18.0   18.0-888.0
1273   1   -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1273   2   -999.0    2.2    2.2-999.0-999.0    1.7    2.3-999.0-888.0
1273   2   -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1273   3       .4     .5     .4     .4     .4     .4     .5     .4-888.0
1273   3   -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1273   4      1.8    3.0    5.0    1.5    1.4    -.6    -.6    -.8-888.0
1273   4   -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1273   5      1.1    1.1    1.1     .9     .6     .6    1.1     .8-888.0
1273   5   -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1273   6   -999.0     .5     .5     .3     .4     .5     .5-999.0-888.0
1273   6   -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


1281    166.    1.93    -7.5   7:50   10:10   3821   571 2172   324
1281   1      62.0   62.0   62.0   36.0   30.0   33.0-999.0   39.0-888.0
1281   1   -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1281   2      5.7    5.9    6.1    5.2    5.2    6.0-999.0    5.2-888.0
1281   2   -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1281   3      1.8    1.9    2.0    1.8    1.6    2.0    1.6    1.6-888.0
1281   3   -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1281   4      5.5    5.9    8.6    3.1    1.4    2.4    1.6    2.5-888.0
1281   4   -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1281   5      1.4    2.5    2.1    1.2     .9    1.1-999.0     .9-888.0
1281   5   -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
1281   6       .6     .9     .8     .5     .3     .5-999.0     .4-888.0
1281   6   -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


2011    291.    6.67    -6.1   8:30   11:10   3098   463 2014   301
2011   1      29.0   43.0   31.0   41.0   32.0   28.0   26.0   28.0-888.0
2011   1   -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2011   2      6.2    6.5    6.5    6.3    5.8    5.4    6.3    6.4-888.0
2011   2   -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2011   3      1.7    2.0    2.0    1.9    2.0    2.0    2.0    1.9-888.0
2011   3   -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2011   4       .9    1.4    1.5    3.5    2.2    1.7    1.4    1.8-888.0
2011   4   -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2011   5       .6     .7     .7    1.2     .9     .6     .7     .7-888.0
2011   5   -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2011   6       .4     .7     .5     .6     .4     .4     .5     .4-888.0
2011   6   -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
```

```
2012   296.   6.24   -3.0  14: 0  17: 0  2678   400 3762   562
2012  1   17.0  19.0  15.0  35.0  26.0  24.0  19.0  24.0-888.0
2012  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2012  2    5.5   6.3   6.0   5.8   5.6   5.5   6.0   6.2-888.0
2012  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2012  3    1.5   1.7   1.6   1.5   1.6   1.5   1.7   1.4-888.0
2012  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2012  4    -.5    .6    .9   4.1   2.4   2.0   2.4   1.9-888.0
2012  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2012  5     .5    .6    .6   1.1    .6    .8    .6    .8-888.0
2012  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2012  6 -999.0    .3-999.0    .3    .3-999.0-999.0-999.0-888.0
2012  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


2021   309.   5.42   -4.6   8:40  11:30  2968   444 1961   293
2021  1   24.0  19.0   9.0  30.0  16.0  23.0  20.0  22.0-888.0
2021  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2021  2    1.4   3.1   3.4   4.1   3.7   3.1   3.8   3.9-888.0
2021  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2021  3     .9    .9    .9    .8    .9    .9    .9    .9-888.0
2021  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2021  4    -.4   -.4    .7   3.2   1.6   2.2   1.1   1.7-888.0
2021  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2021  5     .7    .4    .5   1.0    .7    .6    .6    .7-888.0
2021  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2021  6 -999.0-999.0    .9    .3    .3    .3-999.0    .2-888.0
2021  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


2022   317.   5.37   -1.6  13:40  16:10  2629   393 3379   505
2022  1   14.0  14.0  13.0  11.0  26.0  15.0-888.0-888.0-888.0
2022  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2022  2     .7   2.0   2.1   2.4   1.8   1.8-888.0-888.0-888.0
2022  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2022  3     .5    .5    .6    .5    .4    .6-888.0-888.0-888.0
2022  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2022  4    -.5   -.6   -.6   3.4    .9   1.4-888.0-888.0-888.0
2022  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2022  5     .6    .7    .6    .9    .6    .6-888.0-888.0-888.0
2022  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2022  6 -999.0    .4-999.0    .2-999.0-999.0-888.0-888.0-888.0
2022  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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2031    240.   4.11    -1.8    8:20   11: 0   3234   483 2046   306
2031  1   32.0  15.0  51.0  26.0  27.0  17.0  31.0-888.0-888.0
2031  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2031  2    6.7   6.7   7.3   6.3   2.5   5.3   7.3-888.0-888.0
2031  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2031  3    1.9   1.9   2.0   2.0   2.0   1.8   2.0-888.0-888.0
2031  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2031  4    2.3   2.4   5.5   -.6   -.6   -.5    .8-888.0-888.0
2031  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2031  5     .9   1.2   1.4    .7    .6    .6    .6-888.0-888.0
2031  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2031  6     .9   1.5   1.5   1.0    .8    .7    .8-888.0-888.0
2031  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


2081    340.   4.36    -5.2    8:50   11:10   2987   446 1941   290
2081  1   29.0-888.0  24.0  38.0  25.0  31.0  23.0-888.0-888.0
2081  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2081  2    4.5-888.0   4.2   4.6   4.3   4.1   4.7-888.0-888.0
2081  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2081  3    1.3-888.0   1.3   1.3   1.4   1.3   1.6-888.0-888.0
2081  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2081  4    -.5-888.0   -.5   4.4   2.0   2.2   1.9-888.0-888.0
2081  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2081  5    1.9-888.0    .8   3.0    .9    .9    .6-888.0-888.0
2081  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2081  6     .2-888.0-999.0    .3    .2-999.0-999.0-888.0-888.0
2081  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


2082    339.   3.80    -1.7   11:50   14:10   2141   320 2138   319
2082  1   19.0-888.0  17.0  35.0  26.0  23.0  21.0-888.0-888.0
2082  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2082  2    3.6-888.0   3.9   3.5   4.0   3.2   3.5-888.0-888.0
2082  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2082  3    1.3-888.0   1.2   1.1   1.3    .9   1.3-888.0-888.0
2082  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2082  4    -.5-888.0    .5   3.6   1.3   1.9   1.6-888.0-888.0
2082  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2082  5     .7-888.0    .7   1.9   1.3    .8    .7-888.0-888.0
2082  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2082  6 -999.0-888.0-999.0    .1-999.0-999.0-999.0-888.0-888.0
2082  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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2091   227.   2.71     .1   8:30  11:10   3098   463 2014   301
2091  1   71.0-888.0  66.0  48.0  49.0  66.0  45.0-888.0-888.0
2091  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2091  2   12.8-888.0-999.0  13.9  13.7  11.3   1.5-888.0-888.0
2091  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2091  3    4.1-888.0   3.5   4.8   4.3   3.9   3.5-888.0-888.0
2091  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2091  4    4.2-888.0   6.2   1.8   1.3   1.6    .8-888.0-888.0
2091  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2091  5    1.5-888.0-999.0    .8    .7    .7    .5-888.0-888.0
2091  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2091  6    1.9-888.0-999.0   1.3    .9    .8    .1-888.0-888.0
2091  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


2092   234.   1.82    -.3  12: 0  14:20   2168   324 2189   327
2092  1   34.0-888.0  53.0  28.0  35.0  30.0  29.0-888.0-888.0
2092  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2092  2    7.1-888.0   8.0   7.3   6.9   7.5   8.6-888.0-888.0
2092  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2092  3    2.2-888.0   2.2   2.2   2.2   2.2   2.9-888.0-888.0
2092  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2092  4    2.3-888.0   3.7   -.6   -.6   -.5   -.5-888.0-888.0
2092  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2092  5     .8-888.0   1.1    .5    .4    .7    .7-888.0-888.0
2092  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2092  6     .5-888.0    .5    .5    .3    .4    .4-888.0-888.0
2092  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


2102   327.   5.23    4.2  12:20  13:50   2084   311 2110   315
2102  1   38.0  55.0  46.0  55.0  36.0   4.0  41.0-888.0-888.0
2102  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2102  2   20.0  18.6  19.7  19.0  19.8  20.5-999.0-888.0-888.0
2102  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2102  3    5.6   5.5   5.7   5.6   5.2   6.0   5.9-888.0-888.0
2102  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2102  4    -.5   -.4   -.4   3.4   -.5   2.6   1.4-888.0-888.0
2102  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2102  5     .7    .6   1.0    .8   1.3    .8-999.0-888.0-888.0
2102  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2102  6 -999.0    .4    .5-999.0-999.0-999.0-999.0-888.0-888.0
2102  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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2151    316.   4.13    2.0   9: 0  11:20   2868   428 1921   287
2151  1   36.0  43.0  38.0  54.0  42.0  51.0  45.0-888.0-888.0
2151  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2151  2 -999.0  10.3  10.9  11.3   8.7  11.1  11.7-888.0-888.0
2151  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2151  3    3.5   3.2   3.5   3.6   3.1   3.8   3.6-888.0-888.0
2151  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2151  4     .8    .8   1.3   4.4   1.6   2.6   2.3-888.0-888.0
2151  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2151  5     .7   1.1   1.2   1.3   1.0   1.1   1.4-888.0-888.0
2151  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2151  6    1.0    .7   1.2   1.4   1.1    .8   1.5-888.0-888.0
2151  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


2152    324.   5.27    1.6  12:50  15:30   2404   359 2782   416
2152  1   17.0  24.0  23.0  26.0  23.0  27.0  17.0-888.0-888.0
2152  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2152  2    5.0   4.7   5.3   5.4   4.9   6.0-999.0-888.0-888.0
2152  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2152  3    1.6   1.4   1.6   1.7   1.5   1.5   1.2-888.0-888.0
2152  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2152  4    -.4   -.4   -.4   3.9    .5   1.7   1.0-888.0-888.0
2152  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2152  5     .7    .9    .9   1.0    .8   1.0-999.0-888.0-888.0
2152  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2152  6 -999.0    .2    .1   1.5-999.0   1.0-999.0-888.0-888.0
2152  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


2161    332.   2.53   -7.2   8:50  11:10   2987   446 1941   290
2161  1   39.0  41.0  29.0  36.0  29.0  34.0  25.0-888.0-888.0
2161  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2161  2 -999.0   4.7   5.5   5.6   5.6   2.2   5.6-888.0-888.0
2161  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2161  3    1.8    .6   2.0   5.2   2.1   2.8   2.1-888.0-888.0
2161  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2161  4    -.5    .6   2.0   5.2   2.1   2.8   2.1-888.0-888.0
2161  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2161  5     .9   1.1   1.1   1.2   1.0    .6    .9-888.0-888.0
2161  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2161  6 -999.0    .5-999.0    .3    .3-999.0-999.0-888.0-888.0
2161  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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2162   330.   3.45   -5.2  11:50  14:10  2141   320 2138  319
2162 1   19.0  33.0  18.0  38.0  24.0  27.0  24.0-888.0-888.0
2162 1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2162 2    4.9   4.8   5.1   5.2   5.0   4.0   5.1-888.0-888.0
2162 2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2162 3    1.5   1.4   1.6   1.8   1.6   1.5   1.6-888.0-888.0
2162 3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2162 4     .5    .8    .8   3.5   1.9   2.0   1.6-888.0-888.0
2162 4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2162 5    1.0   1.1   1.0   1.3   1.0   1.0    .9-888.0-888.0
2162 5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2162 6 -999.0    .5    .2    .4    .3    .3    .3-888.0-888.0
2162 6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


2171   330.   5.93   -7.8   9:20  12:10  2588   387 1908  285
2171 1   22.0  21.0  21.0  30.0  15.0  35.0-888.0  33.0-888.0
2171 1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2171 2    3.7   4.5   4.5   4.8   3.6   4.4-888.0   4.3-888.0
2171 2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2171 3    1.5   1.6   1.5   1.3   1.5   1.3-888.0   1.5-888.0
2171 3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2171 4    -.3   -.4   -.3   3.0    .9   2.0-888.0   1.6-888.0
2171 4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2171 5     .7    .8    .7    .7    .4    .6-888.0   1.0-888.0
2171 5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2171 6 -999.0    .6-999.0    .8    .2    .3-888.0-999.0-888.0
2171 6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


2181    19.    .89   -7.7   7: 0   9:30  4383   655 2284  341
2181 1   32.0  41.0  41.0  71.0  51.0  41.0  58.0  55.0-888.0
2181 1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2181 2    7.1   7.5   6.1   7.3   5.7   6.1   2.7   7.4-888.0
2181 2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2181 3    2.4   2.5   2.3   2.4   2.0   2.1   2.1   2.3-888.0
2181 3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2181 4    1.6   2.3   3.6   8.9   4.8   4.4   4.1   4.0-888.0
2181 4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2181 5     .7   1.1    .8   1.8   1.1   1.0   1.0    .9-888.0
2181 5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2181 6     .3-999.0-999.0    .4-999.0    .3-999.0    .1-888.0
2181 6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
```

```
2221    225.   5.84     2.3  13:20  15:20   2461   368 2814   420
2221  1   32.0  46.0  43.0  37.0  32.0  34.0  33.0  35.0-888.0
2221  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2221  2    5.9   8.0   6.4   6.3   6.3   6.5   5.1   6.4-888.0
2221  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2221  3    2.2   2.3   2.2   2.1   2.1   2.2   2.0   1.6-888.0
2221  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2221  4    1.7   2.1   3.8   -.7   -.7   -.7   -.6   -.7-888.0
2221  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2221  5    1.1   2.6   1.5   1.7   1.6   1.4   1.1   1.7-888.0
2221  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2221  6    1.4   2.7   1.5   1.8   1.4   1.6   1.4   2.0-888.0
2221  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


2231     48.   2.76     6.5   8:50  11:10   2987   446 1941   290
2231  1   68.0  64.0  79.0  99.0  88.0  89.0  96.0  87.0-888.0
2231  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2231  2   15.1  18.6  18.8  16.1  17.4  16.1  12.6  17.6-888.0
2231  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2231  3    4.6   5.8   6.1   4.9   5.4   5.0   4.4   5.7-888.0
2231  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2231  4    1.7   2.0   2.6   5.2   3.8   3.8   3.2   3.9-888.0
2231  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2231  5    1.5   2.3   1.5   3.7   2.5   1.7   1.5   1.8-888.0
2231  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2231  6    1.9   3.8   2.3   2.5   1.9   2.1   2.0   2.1-888.0
2231  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


2232     62.   2.78     8.6  11:50  14:10   2141   320 2138   319
2232  1   68.0  84.0  79.0  97.0  85.0  88.0  92.0  85.0-888.0
2232  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2232  2   15.1  18.6  18.8  15.8  17.0  16.1  12.0  17.2-888.0
2232  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2232  3    4.6   5.8   6.1   4.8   5.3   5.0   4.2   5.6-888.0
2232  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2232  4    1.7   2.0   2.6   5.1   3.7   3.8   3.0   3.8-888.0
2232  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2232  5    1.5   2.3   1.5   3.6   2.4   1.7   1.5   1.8-888.0
2232  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2232  6    1.9   3.8   2.3   2.4   1.8   2.1   1.9   2.0-888.0
2232  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
```

```
2241      82.  3.35    2.4  8:50 11:20  2940  439 1940  290
2241  1   29.0  38.0  37.0  60.0  45.0  39.0  38.0  46.0-888.0
2241  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2241  2   10.4  11.4  10.4  10.4  10.8   9.7   8.8  11.1-888.0
2241  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2241  3    2.7   2.9   3.3   3.6   3.4   3.3   3.0   3.5-888.0
2241  3 -888.0-888.0-888.0-888.0-888.0-888.0-883.0-888.0-888.0
2241  4     .5    .8   1.6   7.1   3.7   3.4   2.1   2.8-888.0
2241  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2241  5    2.6   5.6   2.4   2.2   2.4   2.4   3.0   2.3-888.0
2241  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2241  6 -999.0-999.0   1.3   1.2   1.1   1.0    .9   1.3-888.0
2241  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


2242      85.  3.96    3.1 11:50 14:10  2141  320 2138  319
2242  1   35.0  50.0  47.0  58.0  41.0  57.0  45.0  37.0-888.0
2242  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2242  2    8.7  12.4  10.1  10.0   7.9   8.3   9.7   9.0-888.0
2242  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2242  3    3.0   2.5   3.2   3.0   3.0   2.9   3.0   2.5-888.0
2242  3 -888.0-883.0-888.0-888.0-888.0-883.0-888.0-888.0-888.0
2242  4     .6    .9   2.1   5.3   3.2   2.8   2.7   1.5-888.0
2242  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2242  5    3.2   4.2   2.7   4.7   3.9   3.3   3.6   3.4-888.0
2242  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2242  6 -999.0   1.9   1.4   1.3   1.7    .9    .9   1.2-888.0
2242  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


2281     311.  5.48    3.8 13:50 16:10  2664  398 3453  516
2281  1   24.0  22.0  26.0  36.0  29.0  25.0  24.0-888.0-888.0
2281  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2281  2    5.1   5.3   5.4   6.4   5.5   5.6-999.0-888.0-888.0
2281  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2281  3    1.8   1.8   1.8   2.0   1.9   1.9   1.8-888.0-888.0
2281  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2281  4     .5    .4    .7   4.0   1.5   1.9   1.5-888.0-888.0
2281  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2281  5     .4    .5    .9    .5    .5    .4-999.0-888.0-888.0
2281  5 -883.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
2281  6 -999.0-999.0-999.0-999.0-999.0-999.0-999.0-888.0-888.0
2281  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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3011   285.   4.75    2.1   8:50  11:20  2940   439 1940   290
3011  1   39.0  44.0  43.0  53.0  48.0  40.0  38.0-888.0-888.0
3011  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3011  2    8.6   3.7   8.8-999.0   7.7   7.9   7.6-888.0-888.0
3011  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3011  3    2.8   2.6   2.6   2.8   2.4   2.4   2.5-888.0-888.0
3011  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3011  4    1.3   2.3   3.8   4.1   2.4   2.2   1.9-888.0-888.0
3011  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3011  5     .6    .7    .9-999.0    .6    .7    .6-888.0-888.0
3011  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3011  6     .6    .8    .8-999.0    .3    .8    .6-888.0-888.0
3011  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


3012   282.   5.93    5.4  12:50  15:10  2350   351 2616   391
3012  1   31.0  40.0  44.0  43.0  36.0  32.0  31.0-888.0-888.0
3012  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3012  2    6.6   6.8   6.5   6.4   6.0   6.3   6.1-888.0-888.0
3012  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3012  3    2.1   2.0   2.1   2.0   1.8   1.9   1.8-888.0-888.0
3012  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3012  4    1.1   2.0   3.3   2.9   1.8   1.8   1.5-888.0-888.0
3012  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3012  5     .9    .7    .6    .8    .6    .6    .6-888.0-888.0
3012  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3012  6     .4    .8    .8-999.0-999.0-999.0    .2-888.0-888.0
3012  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


3022   297.   4.81    4.8  13:50  16:30  2666   398 3565   533
3022  1   40.0  23.0  25.0  54.0  44.0  32.0  21.0-888.0-888.0
3022  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3022  2    1.2   1.9   2.5   1.5   3.1   3.2   2.2-888.0-888.0
3022  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3022  3     .7    .8    .8    .8    .8    .7    .7-888.0-888.0
3022  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3022  4    1.0    .5   1.7   4.6   3.3   2.4    .8-888.0-888.0
3022  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3022  5     .5    .5    .5    .9    .6    .8    .4-888.0-888.0
3022  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3022  6 -999.0-999.0    .2-999.0-999.0    .2-999.0-888.0-888.0
3022  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
```

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3031   290.   3.23    5.2   8:20  10:40   3366   503 2074   310
3031  1   51.0  62.0  51.0  61.0  47.0  57.0  49.0-888.0-888.0
3031  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3031  2    9.1   9.3   9.1   8.0-999.0   8.7   8.0-888.0-888.0
3031  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3031  3    2.9   2.9   2.8   2.6   2.3   2.5   2.3-888.0-888.0
3031  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3031  4    1.2   1.7   3.5   4.8   2.5   2.3   2.6-888.0-888.0
3031  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3031  5     .8   1.2-999.0   1.2    .5   1.1-999.0-888.0-888.0
3031  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3031  6    1.7   2.1-999.0   1.9    .2   1.8-999.0-888.0-888.0
3031  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


3071   277.   2.31    3.8  15:20  17:40   2669   399 4266   637
3071  1   74.0-888.0  82.0  48.0  53.0  39.0  46.0-888.0-888.0
3071  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3071  2   17.3-888.0  17.5  16.0  16.7  13.6  12.6-888.0-888.0
3071  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3071  3    5.7-888.0   4.7   5.1   5.2   4.5   4.0-888.0-888.0
3071  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3071  4    5.6-888.0   6.5   2.6   2.2   1.7   1.4-888.0-888.0
3071  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3071  5     .6-888.0    .7    .5    .5    .4    .5-888.0-888.0
3071  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3071  6 -999.0-888.0-999.0-999.0-999.0-999.0-999.0-888.0-888.0
3071  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


3081   320.   3.33    3.4   8:50  11:40   2872   429 1924   287
3081  1   24.0-888.0  23.0  38.0  26.0  40.0  39.0-888.0-888.0
3081  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3081  2    4.1-888.0   5.5    .9   4.5   4.9   4.5-888.0-888.0
3081  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3081  3    1.3-888.0   1.8   1.9   1.5   1.5   1.8-888.0-888.0
3081  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3081  4     .6-888.0   1.1   3.9   1.9   2.1   2.0-888.0-888.0
3081  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3081  5     .5-888.0    .5    .1    .5    .6    .5-888.0-888.0
3081  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3081  6 -999.0-888.0-999.0-999.0-999.0    .2-999.0-888.0-888.0
3081  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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3082    303.    3.12     7.7  13:10   15:40   2481    371 2941   440
3082  1    30.0   26.0   31.0   32.0   31.0   27.0   28.0-888.0-888.0
3082  1  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3082  2     4.6    4.2-999.0    4.4    4.8    4.2    4.5-888.0-888.0
3082  2  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3082  3     1.2    1.2    1.5    1.2    1.4    1.4    1.4-888.0-888.0
3082  3  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3082  4      .8    1.2    2.4    4.1    2.6    2.1    2.2-888.0-888.0
3082  4  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3082  5      .6     .4-999.0     .7     .6     .5     .4-888.0-888.0
3082  5  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3082  6  -999.0-999.0-999.0-999.0     .1-999.0     .2-888.0-888.0
3082  6  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


3091    223.    2.85     9.0   9: 0   11:40   2805    419 1907   285
3091  1    64.0   66.0   68.0   54.0   46.0   53.0   40.0   55.0-888.0
3091  1  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3091  2  -999.0   11.7   13.1   12.7   10.7   13.1   10.3   10.6-888.0
3091  2  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3091  3     3.9    3.6    4.3    4.5    3.3    4.5    3.1    3.6-888.0
3091  3  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3091  4     2.8    2.7    6.5    1.6    1.4    1.4    -.5     .9-888.0
3091  4  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3091  5  -999.0-999.0-999.0-999.0-999.0-999.0     .7-999.0-888.0
3091  5  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3091  6  -999.0-999.0-999.0-999.0-999.0-999.0     .6-999.0-888.0
3091  6  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


3092    221.    3.79    10.7  12:50   15:40   2424    362 2855   427
3092  1    48.0   46.0   61.0   53.0   48.0   38.0   27.0   51.0-888.0
3092  1  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3092  2     9.8   10.2   14.8   12.5   12.0   11.3   11.8   11.9-888.0
3092  2  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3092  3     3.8    3.3    4.4    3.8    3.9    3.6    3.5    3.6-888.0
3092  3  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3092  4     2.3    1.9    4.9     .6    -.6     .4     .4    -.4-888.0
3092  4  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3092  5      .3     .6     .5     .4     .5     .4     .5     .4-888.0
3092  5  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3092  6      .6    1.5     .7     .9     .7     .6     .8     .7-888.0
3092  6  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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```
3101    229.   3.76   10.1    9: 0  12: 0  2747   410 1915  286
3101  1   33.0  42.0  42.0  28.0  27.0  26.0  29.0  32.0-888.0
3101  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3101  2    7.9  10.6   8.9  12.0   8.9   9.3   9.0   9.1-888.0
3101  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3101  3    2.5   2.9   2.4   3.1   2.7   2.5   2.9   2.7-888.0
3101  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3101  4    2.3   2.7   4.3    .6    .4   -.3   -.4    .5-888.0
3101  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3101  5     .5   1.2    .9    .6    .5    .6    .5    .5-888.0
3101  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3101  6     .8   2.2   1.3   1.6   1.1   1.2   1.0   1.2-888.0
3101  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


3102    219.   3.43   12.3   12:40  15:10  2339   350 2573  385
3102  1 -888.0  52.0  56.0  41.0  36.0  41.0  37.0  38.0-888.0
3102  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3102  2 -888.0  11.6  11.9   9.8  10.0  10.0   9.9  11.0-888.0
3102  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3102  3 -888.0   3.7   3.6   3.3   3.2   3.4   3.2   2.9-888.0
3102  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3102  4 -888.0   2.9   5.1   -.6   -.6   -.6   -.6   -.6-888.0
3102  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3102  5 -888.0    .7    .8    .5    .4    .5    .7    .8-888.0
3102  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3102  6 -888.0   2.1    .9   1.3    .9    .9    .9    .5-888.0
3102  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


3111    224.   1.16   17.4    9:50  12:20  2411   360 1901  284
3111  1 -888.0  89.0  89.0  78.0  64.0  62.0  48.0  78.0-888.0
3111  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3111  2 -888.0  22.9  24.0  22.4  17.1  18.9  17.3  19.7-888.0
3111  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3111  3 -888.0   5.3   6.0   5.8   5.2   5.5   5.2   5.7-888.0
3111  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3111  4 -888.0   5.0   8.1   3.4   2.3   2.1   1.3   2.5-888.0
3111  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3111  5 -888.0   2.1   2.3   1.7   1.0   1.3   1.1   1.3-888.0
3111  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3111  6 -888.0   2.2   1.6   1.5    .9   1.0   1.0   1.2-888.0
3111  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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3151    344.   4.02     9.9    9:20   11:40   2675  400 1885   282
3151  1 -888.0   2.0   8.0  22.0  14.0  27.0-888.0  11.0-888.0
3151  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3151  2 -888.0   2.2   2.2   3.0   1.9   2.7-888.0   1.8-888.0
3151  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3151  3 -888.0    .5    .6    .7    .6    .8-888.0    .5-888.0
3151  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3151  4 -888.0   -.5   -.5   3.2   1.1   2.5-888.0   1.6-888.0
3151  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3151  5 -888.0    .7    .5    .8    .4    .7-888.0    .8-888.0
3151  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3151  6 -888.0-999.0-999.0-999.0-999.0-999.0-888.0-999.0-888.0
3151  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


3152     21.   1.81    11.1   13:50   16:10   2664   398 3453   516
3152  1   29.0  23.0  17.0  39.0  33.0  29.0-888.0  34.0-888.0
3152  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3152  2    2.5   3.4   2.3   3.0   3.1   1.2-888.0   3.0-888.0
3152  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3152  3     .6    .7    .5    .7    .7    .6-888.0    .6-888.0
3152  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3152  4     .9   1.2   1.0   6.5   3.0   2.9-888.0   2.3-888.0
3152  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3152  5     .6    .7    .5    .9    .8    .8-888.0    .7-888.0
3152  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3152  6 -999.0-999.0-999.0-999.0    .1-999.0-888.0-999.0-888.0
3152  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


3161    264.   3.89     9.3    8:50   11:10   2987  446 1941   290
3161  1   56.0  51.0  62.0  49.0  52.0  50.0-888.0  51.0-888.0
3161  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3161  2   13.4  13.3  15.4  11.3  13.9  15.3-888.0  13.5-888.0
3161  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3161  3    4.4   4.3   5.3   4.2   4.4   4.4-888.0   4.2-888.0
3161  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3161  4    3.0   3.1   5.3   2.3   1.5   1.9-888.0   1.4-888.0
3161  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3161  5     .7    .7    .8    .6    .8    .9-888.0    .8-888.0
3161  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3161  6 -999.0    .7-999.0-999.0-999.0    .3-888.0-999.0-888.0
3161  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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3162    321.   7.77   12.5  13:50  16:10  2664  398 3453  516
3162  1   19.0  16.0  11.0  23.0  20.0  24.0-888.0  14.0-888.0
3162  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3162  2    1.0   2.9   1.0   3.1   3.4   2.7-888.0    .8-888.0
3162  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3162  3    1.1   1.2   1.2   1.0   1.1   1.2-888.0   1.1-888.0
3162  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3162  4    -.1   -.1   -.1   2.2    .6   1.5-888.0    .7-888.0
3162  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3162  5     .5    .5    .5    .9    .7    .7-888.0    .6-888.0
3162  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3162  6 -999.0-999.0-999.0-999.0-999.0-999.0-888.0-999.0-888.0
3162  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


3171    313.   5.56    4.0   9:20  11:20  2728  408 1898  284
3171  1   11.0  14.0  19.0  32.0  16.0  35.0-888.0  16.0-888.0
3171  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3171  2    1.7-999.0    .6-999.0-999.0-999.0-888.0-999.0-888.0
3171  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3171  3     .8    .6    .6    .7    .6    .7-888.0    .7-888.0
3171  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3171  4    -.6   -.6   -.6   3.2   1.5   1.8-888.0   1.6-888.0
3171  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3171  5     .7    .7    .7-999.0    .8   1.0-888.0    .7-888.0
3171  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3171  6 -999.0-999.0-999.0-999.0-999.0-999.0-888.0-999.0-888.0
3171  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


3181    101.   3.22   -1.0   7:20   9:40  4253  636 2281  341
3181  1   30.0  29.0  38.0   5.0  27.0  17.0   5.0-999.0-888.0
3181  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3181  2    2.4   3.1   2.1   1.3    .9   2.8    .7   2.5-888.0
3181  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3181  3     .7    .8    .9    .7    .6    .6    .5    .7-888.0
3181  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3181  4    2.0   3.0   5.4   3.0   1.8   1.0   -.6   -.6-888.0
3181  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3181  5     .8   1.1   1.7    .7    .7    .7    .6    .7-888.0
3181  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3181  6     .5    .6    .8-999.0-999.0-999.0-999.0-999.0-888.0
3181  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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3231    331.   8.73    2.7   9:50  12:10  2438   364 1897   284
3231   1  16.0  16.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3231   1-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3231   2   1.8-999.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3231   2-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3231   3   1.1   1.2-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3231   3-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3231   4   -.6   -.6-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3231   4-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3231   5    .7-999.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3231   5-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3231   6-999.0-999.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3231   6-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


3232    324.   7.96    3.0  13: 0  15:10  2371   354 2650   396
3232   1  24.0  24.0  40.0  30.0  19.0  27.0  31.0  21.0-888.0
3232   1-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3232   2   3.5   3.9   3.8   3.8   3.6   3.6   3.9   4.1-888.0
3232   2-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3232   3   1.5   2.0   1.7   1.5   1.4   1.4   1.9   1.4-888.0
3232   3-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3232   4    .7   -.7   -.7   3.4   1.6   2.5   1.3   2.1-888.0
3232   4-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3232   5    .7   1.6   1.7   1.6   1.5   1.5    .7    .7-888.0
3232   5-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3232   6-999.0-999.0-999.0    .6-999.0-999.0-999.0-999.0-888.0
3232   6-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


3291    236.   2.90   11.3   7: 0   9:40  4320   645 2264   338
3291   1  49.0  50.0  52.0  34.0  31.0  34.0  42.0  31.0-888.0
3291   1-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3291   2   6.0   5.3   4.9   4.7   3.6   4.2   1.3   3.8-888.0
3291   2-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3291   3   1.7   1.7   1.7   1.6   1.4   1.4   1.1   1.6-888.0
3291   3-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3291   4   3.2   3.4   5.4   1.0   1.2   1.0    .9    .9-888.0
3291   4-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3291   5   2.8   3.6   3.0   2.3   2.3   2.0   2.8   2.6-888.0
3291   5-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3291   6   1.3   2.2    .6   1.4    .7   1.5    .9    .9-888.0
3291   6-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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3292    214.    3.26    20.0   13:50   16:30   2666   398 3565   533
3292  1     44.0   51.0   53.0   44.0   40.0   42.0   42.0   44.0-888.0
3292  1  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3292  2      6.6    6.6    6.7    6.7    3.3    6.8    5.3    6.7-888.0
3292  2  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3292  3      2.3    2.1    2.2    2.3    2.3    2.1    1.8    2.3-888.0
3292  3  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3292  4      2.8    1.9    3.7    -.6    -.6    -.6    -.6    -.5-888.0
3292  4  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3292  5       .7     .6     .6     .4     .6     .3     .4     .4-888.0
3292  5  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3292  6      1.5    2.6    1.5    2.5    1.8    1.7    1.9    2.0-888.0
3292  6  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


3301    202.    1.10    15.9    7:50   10:10   3821   571 2172   324
3301  1     67.0   35.0   81.0   66.0   62.0   52.0   49.0   60.0-888.0
3301  1  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3301  2     11.6   12.9   12.5   12.0   11.9   11.6    7.6   12.1-888.0
3301  2  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3301  3      3.6    3.8    3.5    3.6    3.5    3.5    2.5    3.6-888.0
3301  3  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3301  4      4.8    6.1    7.4    4.3    2.9    2.9    1.4    2.1-888.0
3301  4  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3301  5      1.7    2.4    5.0    1.7    1.7    1.5    2.0    1.4-888.0
3301  5  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3301  6      1.3    3.1    2.3    1.8    1.5    1.6    1.6    1.5-888.0
3301  6  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


3302    200.    3.29    18.6   12: 0   14:40   2227   333 2264   338
3302  1     42.0   42.0   45.0   40.0   31.0   36.0   31.0   36.0-888.0
3302  1  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3302  2     10.8   10.6   11.5   10.2    9.6   10.2    7.2    9.9-888.0
3302  2  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3302  3      3.5    3.3    3.9    3.4    3.1    3.3    2.5    3.2-888.0
3302  3  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3302  4      2.1    1.2    3.0    -.6    -.6    -.6    -.6    -.6-888.0
3302  4  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3302  5      1.8     .9    1.2     .9    1.2    1.3    1.1    1.2-888.0
3302  5  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3302  6       .3     .5-999.0     .5-999.0     .5     .3-999.0-888.0
3302  6  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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3311    269.   1.73   14.7   6:40   9:30   4411   659 2191   327
3311  1   71.0  65.0  59.0  58.0  46.0  49.0  33.0  46.0-888.0
3311  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3311  2    6.6   7.2   7.3   7.3   6.8   7.1   3.5   7.2-888.0
3311  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3311  3    2.2   2.2   2.0   2.4   2.2   2.4   1.2   2.4-888.0
3311  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3311  4    3.4   3.4   5.2   4.0   2.7   1.9   -.5   1.6-888.0
3311  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3311  5    2.5   3.5   3.7   2.9   3.1   3.1   2.2   2.1-888.0
3311  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3311  6     .8   1.8   1.4    .9    .7    .8    .6    .8-888.0
3311  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


3312    325.   9.85   12.4  12:50  15:10   2350   351 2616   391
3312  1   18.0  22.0  13.0  31.0  15.0  36.0  27.0  22.0-888.0
3312  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3312  2    2.4   1.9   3.2   2.3   2.9   2.1-999.0   3.0-888.0
3312  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3312  3     .9    .9    .9   1.0    .9   1.0    .9   1.0-888.0
3312  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3312  4    -.6   -.6   -.6   2.0   -.6    .7    .5    .6-888.0
3312  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3312  5     .7    .4    .9   1.2   2.0   1.2-999.0    .6-888.0
3312  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
3312  6 -999.0-999.0   1.0-999.0-999.0-999.0-999.0-999.0-888.0
3312  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


4011    323.   6.44    4.2   6:40   9:20   4490   671 2205   329
4011  1   17.0  13.0   7.0  29.0  22.0  20.0  22.0  22.0-888.0
4011  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4011  2 -999.0   2.3   1.2   2.5-999.0   2.0   1.9   1.4-888.0
4011  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4011  3     .9    .8    .9    .9    .9    .9    .8    .9-888.0
4011  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4011  4    -.5   -.5   -.5   1.0    .7   1.4    .9   1.0-888.0
4011  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4011  5 -999.0    .2    .3    .4-999.0    .3    .3    .5-888.0
4011  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4011  6 -999.0-999.0-999.0    .2-999.0-999.0-999.0-999.0-888.0
4011  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
```

```
4012   325.  5.09   7.5 10: 0 12:20  2371  354 1904  284
4012  1   12.0  14.0  13.0  30.0  16.0  26.0  19.0  61.0-888.0
4012  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4012  2    2.2   2.0   2.0   2.6   2.4   2.0   1.7   2.2-888.0
4012  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4012  3     .9    .8    .9   1.0    .9    .8    .6    .9-888.0
4012  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4012  4    -.5   -.5   -.5   2.6    .6   1.1    .9    .9-888.0
4012  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4012  5     .3    .5    .5    .5    .5    .5    .4    .4-888.0
4012  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4012  6 -999.0-999.0-999.0    .3-999.0-999.0-999.0-999.0-888.0
4012  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


4051   223.  5.58  10.2 12:50 16:10  2490  372 3088  461
4051  1   12.0-999.0  14.0-999.0   2.0   9.0  16.0-999.0-888.0
4051  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4051  2    2.1   2.4   1.3   2.6    .9   2.1   2.1   2.1-888.0
4051  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4051  3     .8    .8    .8    .8    .8    .8    .7    .7-888.0
4051  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4051  4    2.4   1.4   3.4    .6   -.5   -.5    .6    .7-888.0
4051  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4051  5     .4    .6   1.0   1.3    .3    .5    .7    .5-888.0
4051  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4051  6     .3    .3    .9    .6-999.0-999.0-999.0-999.0-888.0
4051  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


4071   249.  3.67   4.5 11:50 15: 0  2266  339 2370  354
4071  1   34.0  40.0  48.0  27.0  27.0  26.0  39.0  24.0-888.0
4071  1   21.0  10.0  24.0  11.0  11.0   8.0   9.0  14.0-888.0
4071  2    5.6   5.9   7.1   5.1   5.7   5.2   4.2   4.7-888.0
4071  2 -999.0-999.0   2.3 999.0-999.0-999.0-999.0-999.0-888.0
4071  3    2.1   1.9   2.1   2.0   2.1   2.0   1.5   1.8-888.0
4071  3     .2    .1    .2    .1    .2    .2    .1    .2-888.0
4071  4    2.6   2.4   4.9   1.7   1.4    .6   -.4    .9-888.0
4071  4     .5   -.4   -.4    .6    .4   -.4   -.4   -.4-888.0
4071  5     .5    .4    .6    .4    .4    .3    .4    .4-888.0
4071  5     .4    .3    .6    .3    .4    .4    .3-999.0-888.0
4071  6     .3    .6    .3    .6-999.0-999.0    .3-999.0-888.0
4071  6     .3-999.0-999.0-999.0    .2-999.0    .3-999.0-888.0
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4081   314.   7.91    4.5   8:40  10:50   3158   472 1979   296
4081  1   23.0  24.0   4.0  27.0  28.0  23.0  24.0  34.0-888.0
4081  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4081  2    2.8   2.2   1.7-999.0   2.5   3.0   1.8   3.4-888.0
4081  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4081  3    1.2    .9   1.1    .9    .9   1.1   1.1   1.1-888.0
4081  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4081  4    -.5   1.3    .5   2.3   1.1   1.8   -.5   1.2-888.0
4081  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4081  5     .5    .5    .5    .5    .9    .6    .5    .6-888.0
4081  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4081  6 -999.0-999.0-999.0    .5-999.0-999.0-999.0-999.0-888.0
4081  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


4082    320.   8.70    3.9  12:50  15:20   2376   355 2680   400
4082  1   16.0   7.0   9.0  18.0  18.0  16.0  24.0  14.0-888.0
4082  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4082  2    2.6   2.4   2.7   2.9   1.8   2.5   2.8   2.7-888.0
4082  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4082  3     .9    .8    .9    .7    .7   1.0    .8    .8-888.0
4082  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4082  4    -.6    .8   -.6   1.6   -.6   1.5   -.6    .9-888.0
4082  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4082  5     .6    .3   1.5    .5    .4    .4   1.4    .7-888.0
4082  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4082  6 -999.0-999.0-999.0-999.0   2.6-999.0-999.0-999.0-888.0
4082  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


4111   144.   4.08    7.7   9:20  11:40   2675   400 1885   282
4111  1   29.0  27.0  25.0-888.0  25.0  22.0  27.0  22.0-888.0
4111  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4111  2    4.0   4.5-999.0-888.0   3.9   4.8   3.6   4.2-888.0
4111  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4111  3    1.6   1.6   1.6-888.0   1.7   1.5   1.3   1.4-888.0
4111  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4111  4    2.0   1.9   3.8-888.0  -1.0   -.5   -.6   -.5-888.0
4111  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4111  5     .8   1.2    .8-888.0   1.1    .7    .9    .8-888.0
4111  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4111  6     .8   1.3    .7-888.0    .8    .8    .9   1.0-888.0
4111  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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4112   188.   3.27    9.3  14:50  17:10   2702   404 4177   624
4112  1    35.0  44.0  41.0  36.0  27.0  29.0  48.0  36.0-888.0
4112  1  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4112  2     9.4   9.6  10.4  11.0   9.5-999.0   7.0  10.5-888.0
4112  2  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4112  3     3.1   2.8   3.2   3.1   2.7   2.8   2.1   2.8-888.0
4112  3  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4112  4     2.4   2.3   5.0    .7    .6   -.6   -.6    .6-888.0
4112  4  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4112  5      .7   1.1    .8    .9    .6    .6   1.0    .6-888.0
4112  5  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4112  6     1.1   2.7   1.1   1.7   1.2-999.0   1.8   1.3-888.0
4112  6  -888.0-888.0-888.0-868.0-888.0-888.0-888.0-888.0-888.0


4121   264.   3.31   17.9   7: 0   9:20   4470   668 2307   345
4121  1    87.0 113.0 101.0  99.0  83.0  77.0 131.0  77.0-888.0
4121  1  -888.0-883.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4121  2    20.3  21.8  20.5  21.7  21.4  21.1  15.0  20.8-888.0
4121  2  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4121  3     6.1   5.9   6.4   6.3   5.6   6.1   4.6   6.1-888.0
4121  3  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4121  4     4.3   5.6   7.3   5.3   4.1   2.7   2.0   1.8-888.0
4121  4  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4121  5      .6    .9    .9    .8    .7    .6    .8    .7-888.0
4121  5  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4121  6     1.2   2.4   1.3   1.6   1.0   1.1   1.0    .9-888.0
4121  6  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


4122   308.   4.59   28.0  11:50  14: 0   2113   316 2123   317
4122  1    49.0  66.0  72.0  69.0-888.0-888.0  63.0  54.0-888.0
4122  1  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4122  2     9.2  10.0  10.5  10.3-888.0-888.0   8.0   9.5-888.0
4122  2  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4122  3     3.0   2.9   3.4   3.1-888.0-888.0   2.4   3.1-888.0
4122  3  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4122  4     -.7   -.7   1.0   4.0-888.0-888.0   1.3   1.7-888.0
4122  4  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4122  5      .5    .5    .5    .6-888.0-888.0    .5    .5-888.0
4122  5  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4122  6  -999.0    .7-999.0    .8-888.0-888.0    .4-999.0-888.0
4122  6  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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4141   332.  5.70  13.4  8:40 11:20  2995  448 1974  295
4141  1  24.0  19.0  17.0  29.0  20.0  22.0  38.0  27.0-888.0
4141  1-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4141  2   3.0   3.0-999.0   2.9   3.0   2.1   1.0   3.2-888.0
4141  2-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4141  3    .8    .8    .8   1.1    .6    .7    .7    .6-888.0
4141  3-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4141  4   -.7   -.7   -.7   2.8    .6   2.0   -.6   1.0-888.0
4141  4-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4141  5   1.3   1.1-999.0    .5    .5    .2    .5    .6-888.0
4141  5-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4141  6-999.0-999.0-999.0-999.0-999.0    .1-999.0    .6-888.0
4141  6-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


4142   328.  7.88  17.0 12:50 15: 0  2326  348 2537  379
4142  1  48.0  30.0  23.0  21.0  21.0  20.0  80.0  22.0-888.0
4142  1-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4142  2   1.6   2.4   2.1   2.5   2.4   2.0   1.9   2.7-888.0
4142  2-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4142  3    .5    .6    .6    .7    .6    .6    .5    .6-888.0
4142  3-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4142  4   -.6   -.6   -.6   2.7    .9   1.6    .7    .8-888.0
4142  4-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4142  5    .8   1.3    .9   1.2   1.5   1.7   1.0   1.5-888.0
4142  5-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4142  6-999.0-999.0-999.0    .2    .2    .2    .2    .7-888.0
4142  6-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


4151     4.  1.88   8.7  6:40  9: 0  4595  687 2223  332
4151  1  21.0  28.0  19.0  27.0  43.0  23.0  32.0  23.0-888.0
4151  1-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4151  2   2.3   2.4   2.3   2.4   2.9   2.3   1.6   2.3-888.0
4151  2-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4151  3    .6    .6    .6    .7    .7    .6    .5    .8-888.0
4151  3-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4151  4   -.6    .7   1.4   3.1   5.3   2.0    .9   1.4-888.0
4151  4-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4151  5   1.1   1.3   1.4   1.2   2.0   1.0   1.7   1.1-888.0
4151  5-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4151  6-999.0-999.0-999.0    .2-999.0    .1    .1    .2-888.0
4151  6-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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4152   236.   3.73   13.5  11:50  14:20  2174  325 2178  325
4152  1   26.0  44.0  45.0  41.0  49.0  48.0-888.0  34.0-888.0
4152  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4152  2    4.5   3.6   5.5   4.9   4.7   4.8-888.0   4.6-888.0
4152  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4152  3    1.3   1.6   1.5   1.6   1.3   1.4-888.0   1.3-888.0
4152  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4152  4    2.1   3.1   5.4   1.9    .7   -.6-888.0    .9-888.0
4152  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4152  5    1.2   1.0   1.2   1.1  14.1    .5-888.0   1.4-888.0
4152  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4152  6     .6-999.0   2.6    .6    .4    .9-888.0-999.0-888.0
4152  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


4182   224.   3.41   18.2  13: 0  15:30  2426  363 2822  422
4182  1   54.0  60.0  34.0  58.0  69.0  48.0  69.0  57.0-888.0
4182  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4182  2   10.6  10.7   9.5   9.2  10.4-999.0   8.1   9.3-888.0
4182  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4182  3    3.2   3.0   3.0   3.3   3.0   2.8   2.4   2.8-888.0
4182  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4182  4    3.1   3.1   5.3   1.3   1.3   1.0   1.0   1.2-888.0
4182  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4182  5    1.0    .9    .8    .6    .3-999.0   1.0    .9-888.0
4182  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4182  6     .5-999.0    .5    .2    .5-999.0   1.0-999.0-888.0
4182  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


4191    34.   3.01   16.1   7: 0   9:30  4383  655 2284  341
4191  1   33.0  26.0  12.0-888.0  41.0  36.0  30.0  31.0-888.0
4191  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4191  2    5.2-999.0   5.5-888.0   4.9   5.6   3.9   5.0-888.0
4191  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4191  3    1.9   1.8   1.7-888.0   1.6   1.6   1.3   1.5-888.0
4191  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4191  4     .7    .9   1.1-888.0   2.1   2.8   1.8   2.1-888.0
4191  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4191  5     .5-999.0    .5-888.0    .7    .8    .6    .5-888.0
4191  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4191  6 -999.0-999.0-999.0-888.0    .4-999.0    .3-999.0-888.0
4191  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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4192    156.    2.69    20.1   11:20   13:30   2135   319 2013   301
4192  1     23.0  46.0  38.0  30.0  18.0  29.0  32.0  32.0-888.0
4192  1  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4192  2      4.8   4.3   5.0   4.6   4.4   4.7   2.9   5.0-888.0
4192  2  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4192  3      1.4   1.4   1.6   1.4   1.3   1.3   1.0   1.4-888.0
4192  3  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4192  4      1.7   1.1   2.4   1.8   1.0   -.6   -.6    .8-888.0
4192  4  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4192  5       .6    .6    .7    .6    .4    .7    .6    .7-888.0
4192  5  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4192  6       .3-999.0    .8-999.0-999.0    .2    .2    .2-888.0
4192  6  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


4201    128.    1.95    11.9    7: 0    9:50   4247   635 2241   335
4201  1     22.0  32.0  39.0  30.0  21.0  25.0  19.0  24.0-888.0
4201  1  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4201  2      2.7   3.0   3.0   2.8   3.1   1.2    .7   2.4-888.0
4201  2  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4201  3       .7    .5    .9    .8    .7    .7    .6    .8-888.0
4201  3  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4201  4      1.6   2.5   4.0   1.7    .6   -.6   -.6    .7-888.0
4201  4  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4201  5       .8    .6    .9    .8    .7    .7   1.0    .5-888.0
4201  5  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4201  6       .5    .6    .5    .4    .2    .5-999.0    .2-888.0
4201  6  -888.0-888.0-88
4201  6  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


4202    186.    2.51    15.1   11:50   14:10   2141   320 2138   319
4202  1     25.0  33.0  27.0  13.0  15.0  24.0  17.0  17.0-888.0
4202  1  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4202  2      1.7   2.7   2.7-999.0-999.0   3.6   1.6   2.3-888.0
4202  2  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4202  3      1.2   1.0   1.1   1.0   1.0   1.1    .8   1.1-888.0
4202  3  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4202  4      1.7   1.5   3.2   -.5   -.5   -.5   -.5   -.5-888.0
4202  4  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4202  5       .6    .8    .8-999.0-999.0    .7    .8    .7-888.0
4202  5  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4202  6       .4    .8    .5-999.0-999.0    .6    .7    .6-888.0
4202  6  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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4211   283.    .99   20.2  10:20  12:50   2269   339 1928   288
4211  1   39.0  52.0  47.0  36.0  16.0  31.0  27.0  34.0-888.0
4211  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4211  2    6.0   6.4   6.6   6.0   5.9   6.5   5.7   5.6-888.0
4211  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4211  3    1.7   1.7   1.9   1.7   1.5   1.3   1.3   1.6-888.0
4211  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4211  4    2.2   2.6   4.4    .8   -.6   -.6   -.6   -.6-888.0
4211  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4211  5    2.1    .7   1.2    .8   1.2   1.0    .8    .8-888.0
4211  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4211  6     .8   1.7    .6   1.1   1.0    .9   1.1   1.3-888.0
4211  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


4212   223.    .19   18.4  14:20  16:40   2730   408 3855   576
4212  1   25.0  18.0  39.0  14.0   9.0  13.0  20.0  16.0-888.0
4212  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4212  2    1.8   4.0   2.0   4.3-999.0   3.2   2.8   4.9-888.0
4212  2 -888.0-888.0-888.0-888.0-838.0-888.0-889.0-888.0-888.0
4212  3    1.1   1.0   1.1   1.1   1.1   1.1    .7   1.1-888.0
4212  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4212  4    1.9   1.3   4.1   -.6    .8   -.6   -.6   -.6-888.0
4212  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4212  5     .7   1.0   1.0    .6-999.0    .7    .7    .7-888.0
4212  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4212  6     .6    .8-999.0    .8-999.0    .9    .7-999.0-888.0
4212  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


4221   280.   1.11   16.7   6:50   9:20   4484   670 2260   338
4221  1   57.0  80.0  70.0  57.0  61.0  59.0-888.0  55.0-888.0
4221  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4221  2   18.7  16.4  1[illegible].9  18.2  18.8  18.2-888.0  16.4-888.0
4221  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4221  3    4.3   4.1   4.2   4.2   4.5   4.3-888.0   4.5-888.0
4221  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4221  4    3.7   3.2   5.9   1.7   1.2   1.5-888.0   1.4-888.0
4221  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4221  5    1.0   1.6   1.6   1.3   1.0   1.3-888.0    .9-888.0
4221  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4221  6     .7   1.4    .7   1.0    .6    .8-888.0-999.0-888.0
4221  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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4222    280.    1.02    22.4  12: 0  14:20  2168  324 2189  327
4222  1     63.0  73.0  66.0  64.0  47.0  51.0-888.0  65.0-888.0
4222  1  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4222  2     18.1  21.8  18.3  16.7  16.8  21.6-888.0  15.9-888.0
4222  2  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4222  3      4.6   5.2   5.0   4.8   4.5   5.0-888.0   4.9-888.0
4222  3  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4222  4      2.2   1.6   4.1   -.6   -.6   -.6-888.0   -.6-888.0
4222  4  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4222  5       .9    .6    .4    .6    .8    .7-888.0    .8-888.0
4222  5  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4222  6       .4   1.5-999.0    .8    .4    .8-888.0-999.0-888.0
4222  6  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


4251     12.    2.00     5.5   8:30  11: 0  3148  470 2012  331
4251  1     19.0  13.0  23.0  54.0  30.0  39.0-888.0  77.0-888.0
4251  1  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4251  2      4.4   4.3   5.4   6.9   4.5   5.4-888.0   6.1-888.0
4251  2  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4251  3      2.2   2.0   2.3   2.2   2.1   2.1-888.0   2.0-888.0
4251  3  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4251  4      -.6   -.6   -.6   3.5   2.1   2.4-888.0   1.6-888.0
4251  4  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4251  5       .5    .9    .7    .7    .8    .7-888.0    .8-888.0
4251  5  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4251  6  -999.0    .1-999.0-999.0-999.0-999.0-888.0    .5-888.0
4251  6  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


4252    213.    1.49    10.0  14:10  16:40  2719  406 3761  552
4252  1     42.0-888.0  72.0  31.0  24.0  32.0-888.0  31.0-888.0
4252  1  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4252  2      6.2-888.0   6.9   5.5   4.9   6.1-888.0   4.3-888.0
4252  2  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4252  3      2.1-888.0   2.2   2.1   2.1   2.1-888.0   2.1-888.0
4252  3  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4252  4      3.1-888.0   6.0   1.7   1.1   1.2-888.0    .7-888.0
4252  4  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4252  5       .5-888.0    .8    .9    .8    .8-888.0    .7-888.0
4252  5  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4252  6       .2-888.0-999.0    .2    .3-999.0-888.0-999.0-888.0
4252  6  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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4261   192.   .94   7.0  6:50  9:20  4484  670 2260  338
4261  1   55.0-888.0  62.0  38.0  29.0  31.0-888.0  36.0-888.0
4261  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4261  2   11.5-888.0  11.4   8.9   6.7   7.5-888.0   7.2-888.0
4261  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4261  3    3.0-888.0   3.3   3.0   2.9   3.1-888.0   3.2-888.0
4261  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4261  4    4.6-888.0   7.5   2.9   1.8   1.3-888.0    .9-888.0
4261  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4261  5    1.0-888.0   1.4    .8    .7    .8-888.0    .8-888.0
4261  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4261  6     .4-888.0-999.0-999.0-999.0    .3-888.0-999.0-888.0
4261  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


4262   183.  1.25   7.2 10:50 13:10  2163  323 1962  293
4262  1   28.0-888.0  45.0  24.0  31.0  26.0-888.0  25.0-888.0
4262  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4262  2    6.8-888.0   6.4-999.0-999.0   1.3-888.0   5.5-888.0
4262  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4262  3    2.0-888.0   2.3   3.3   2.2   1.9-888.0   2.1-888.0
4262  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4262  4    2.0-888.0   5.1   1.1    .6   -.5-888.0   -.5-888.0
4262  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4262  5     .6-888.0    .5-999.0-999.0    .5-888.0   1.0-888.0
4262  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4262  6     .2-888.0   1.0-999.0-999.0-999.0-888.0-999.0-888.0
4262  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


4272   224.  1.81   8.6 10:30 13:10  2208  330 1949  291
4272  1   42.0-888.0  53.0  38.0 141.0  32.0-888.0  38.0-888.0
4272  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4272  2    4.8-888.0  12.9  10.2   7.7   6.8-888.0   2.0-888.0
4272  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4272  3    3.1-888.0   3.4   3.3   3.1   2.7-888.0   3.0-888.0
4272  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4272  4    1.9-888.0   3.9   1.5    .9    .7-888.0    .8-888.0
4272  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4272  5     .8-888.0    .9    .8    .7    .9-888.0    .6-888.0
4272  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4272  6 -999.0-888.0    .3-999.0-999.0-999.0-888.0-999.0-888.0
4272  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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4281   244.   2.67   12.5   8:40  11:10  3043  455 1977  295
4281  1    83.0-888.0  97.0  68.0  49.0  59.0-888.0-888.0-888.0
4281  1  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-388.0
4281  2    18.3-888.0  22.1  18.8  18.7  20.5-888.0-888.0-888.0
4281  2  -888.0-888.0-888.0-888.0-838.0-888.0-888.0-888.0-388.0
4281  3     4.7-838.0   5.0   5.0   4.4   5.0-888.0-888.0-888.0
4281  3  -888.0-888.0-388.0-888.0-838.0-888.0-888.0-888.0-888.0
4281  4     3.3-888.0   6.9   2.1   1.3   1.4-888.0-888.0-888.0
4281  4  -888.0-888.0-388.0-888.0-888.0-888.0-888.0-888.0-888.0
4281  5     1.8-888.0   2.7   1.5   1.5   1.4-888.0-888.0-388.0
4281  5  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4281  6     1.1-888.0   1.3   1.2    .7    .6-888.0-888.0-888.0
4281  6  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


4282   298.   3.64   17.8  11:30  13:50  2130  318 2050  306
4282  1    36.0  45.0  49.0  61.0  53.0  45.0-888.0-888.0-883.0
4282  1  -888.0-888.0-888.0-888.0-888.0-883.0-888.0-888.0-888.0
4282  2    10.5  10.1  10.1  11.9  11.8  14.3-888.0-888.0-388.0
4282  2  -888.0-888.0-888.0-888.0-888.0-388.0-888.0-888.0-838.0
4282  3     2.9   3.5   3.5   2.8   3.3   3.3-888.0-888.0-888.0
4282  3  -883.0-888.0-888.0-888.0-888.0-886.0-883.0-888.0-388.0
4282  4     1.5   2.0   2.8   2.9   2.4   1.5-888.0-888.0-888.0
4282  4  -888.0-838.0-838.0-888.0-838.0-888.0-888.0-888.0-888.0
4282  5      .5    .6    .7    .7    .6    .5-883.0-888.0-888.0
4282  5  -888.0-883.0-888.0-888.0-888.0-888.0-883.0-888.0-388.0
4282  6      .2    .7    .5-999.0-999.0    .4-883.0-888.0-388.0
4282  6  -883.0-888.0-388.0-888.0-888.0-388.0-838.0-888.0-888.0


4291   360.   5.64    3.2   6:40   8:10  4867  727 2142  320
4291  1     5.0    .0  22.0  31.0   7.0    .0-888.0-888.0-888.0
4291  1  -838.0-888.0-888.0-888.0-888.0-388.0-888.0-388.0-388.0
4291  2     1.0   1.0   1.4   3.1   2.3   1.0-888.0-888.0-888.0
4291  2  -888.0-888.0-888.0-888.0-888.0-888.0-883.0-888.0-838.0
4291  3      .8    .9    .8    .9    .8    .3-888.0-888.0-388.0
4291  3  -888.0-888.0-888.0-888.0-838.0-888.0-883.0-888.0-888.0
4291  4     -.4   -.5   -.5   3.3    .8    .6-883.0-888.0-888.0
4291  4  -883.0-888.0-388.0-888.0-888.0-888.0-888.0-888.0-888.0
4291  5      .8    .6    .6   1.0    .6    .4-888.0-888.0-388.0
4291  5  -888.0-883.0-888.0-888.0-838.0-388.0-888.0-888.0-388.0
4291  6  -999.0-999.0-999.0    .1-999.0    .1-888.0-888.0-888.0
4291  6  -883.0-883.0-838.0-888.0-888.0-888.0-888.0-888.0-388.0
```

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4292    329.   4.34    8.5  10:40  13:10  2183  326 1951  292
4292  1   12.0  15.0  19.0  27.0  14.0  27.0-888.0-888.0-888.0
4292  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4292  2    1.6-999.0-999.0   2.6   3.3   2.8-888.0-888.0-888.0
4292  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4292  3     .7    .7    .7    .8    .7    .8-888.0-888.0-888.0
4292  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4292  4    -.5   -.5   -.5   3.6   1.6   1.8-888.0-888.0-888.0
4292  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4292  5     .9-999.0-999.0    .7    .5    .7-888.0-888.0-888.0
4292  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
4292  6 -999.0-999.0-999.0    .2    .1    .4-888.0-888.0-888.0
4292  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


5021    225.   3.78   15.8   8: 0  10:50  3468  518 2092  313
5021  1   45.0  42.0  45.0  28.0  26.0  27.0-888.0-888.0-888.0
5021  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5021  2    6.1   2.4   5.9   4.0   5.7   5.6-888.0-888.0-888.0
5021  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5021  3    1.6   1.8   1.6   1.4   1.6   1.6-888.0-888.0-888.0
5021  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5021  4    2.1   2.2   4.2   -.6   -.6   -.5-888.0-888.0-888.0
5021  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5021  5    1.2   1.2    .9    .8    .8    .5-888.0-888.0-888.0
5021  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5021  6    1.2   1.5   1.0   1.0   1.0    .9-888.0-888.0-888.0
5021  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


5022    213.   2.40   14.4  12:20  15: 0  2287  342 2432  363
5022  1   34.0  36.0  39.0  30.0  28.0  24.0-888.0-888.0-888.0
5022  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5022  2    7.4   5.5   6.5   6.2   6.5-999.0-888.0-888.0-888.0
5022  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5022  3    1.9   1.8   1.8   1.9   1.8   1.8-888.0-888.0-888.0
5022  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5022  4    4.1   3.4   5.0   1.3    .7    .7-888.0-888.0-888.0
5022  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5022  5    1.3   1.0   1.1   1.0   1.1-999.0-888.0-888.0-888.0
5022  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5022  6    1.9   1.2   1.5   2.2   1.4-999.0-888.0-888.0-888.0
5022  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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5031    359.    4.04    13.3    7: 0    9:40   4320   645 2264   338
5031  1     7.0  16.0   2.0  22.0   9.0  17.0-888.0-888.0-888.0
5031  1  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5031  2     2.6   1.0   3.3   1.1   2.7   2.3-888.0-888.0-888.0
5031  2  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5031  3      .7    .8    .8    .6    .7    .8-888.0-888.0-888.0
5031  3  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5031  4     -.6   -.6   -.6   2.6   1.1   2.1-888.0-888.0-888.0
5031  4  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5031  5      .8    .8    .4    .8    .7    .8-888.0-888.0-888.0
5031  5  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5031  6      .1-999.0    .2-999.0    .2    .2-888.0-888.0-888.0
5031  6  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


5032    337.    2.99    17.2   11:30   14: 0   2140   320 2082   311
5032  1    12.0  18.0  12.0  30.0  23.0  18.0-888.0-888.0-888.0
5032  1  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5032  2      .9   2.9   2.0   2.9   3.0   2.7-888.0-888.0-888.0
5032  2  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5032  3      .9   1.0   1.0   1.1   1.0   1.0-888.0-888.0-888.0
5032  3  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5032  4     -.6    .6   -.6   3.8   1.9   1.8-888.0-888.0-888.0
5032  4  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5032  5      .6    .3    .4    .5    .4    .5-888.0-888.0-888.0
5032  5  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5032  6  -999.0-999.0-999.0   2.2    .3-999.0-888.0-888.0-888.0
5032  6  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


5041    149.    1.52    13.8    8:10   10:40   3432   513 2107   315
5041  1    28.0  30.0  42.0  18.0  18.0  11.0-888.0-888.0-888.0
5041  1  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5041  2     2.1   3.5   2.4   1.1   3.2   1.6-888.0-888.0-888.0
5041  2  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5041  3      .7    .8    .8    .8    .7    .8-888.0-888.0-888.0
5041  3  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5041  4     1.6   2.3   4.1   2.4    .8   -.6-888.0-888.0-888.0
5041  4  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5041  5      .5    .6    .6    .5    .7    .4-888.0-888.0-888.0
5041  5  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5041  6      .2-999.0-999.0-999.0    .3-999.0-888.0-888.0-888.0
5041  6  -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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5042   195.   2.64   13.5  11:20  13:50  2137  319 2043  305
5042  1  24.0  31.0  45.0  24.0  22.0  20.0-888.0-888.0-888.0
5042  1-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5042  2   3.1   4.3   4.8   3.4   3.4   2.7-888.0-888.0-888.0
5042  2-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5042  3   1.0   1.1   1.1   1.1    .9   1.1-888.0-888.0-888.0
5042  3-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5042  4   1.8   2.3   4.4   -.5   -.5   -.6-888.0-888.0-888.0
5042  4-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5042  5    .5   1.2    .7    .6    .5    .4-888.0-888.0-888.0
5042  5-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5042  6-999.0    .2    .2    .5-999.0    .1-888.0-888.0-888.0
5042  6-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


5111   348.   2.15   12.9   9:20  12:30  2535  379 1912  286
5111  1  12.0   5.0-888.0  29.0-999.0  23.0-888.0-888.0-888.0
5111  1-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5111  2   2.6   1.2-888.0   1.3-999.0   1.5-888.0-888.0-888.0
5111  2-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5111  3    .5    .5-888.0    .6    .4    .3-888.0-888.0-888.0
5111  3-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5111  4   -.5   -.5-888.0   3.0   -.8   1.8-888.0-888.0-888.0
5111  4-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5111  5    .7    .5-888.0    .7   1.3    .8-888.0-888.0-888.0
5111  5-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5111  6-999.0    .1-888.0    .3-999.0    .3-888.0-888.0-888.0
5111  6-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


5121   283.   2.34   16.9   7:10   9:30  4370  653 2293  343
5121  1  16.0  21.0  31.0  44.0  22.0  29.0  27.0  31.0-888.0
5121  1-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5121  2   2.7   2.6   4.2   3.4   2.3   3.5   1.4   2.8-888.0
5121  2-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5121  3    .9    .9    .9   1.0    .9    .9    .8   1.0-888.0
5121  3-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5121  4    .6   1.1   1.8   4.7   2.5   2.5   2.2   2.2-888.0
5121  4-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5121  5    .4    .4    .5   1.2    .5   1.0    .9    .4-888.0
5121  5-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5121  6    .1    .3    .3    .2-999.0    .1    .3-999.0-888.0
5121  6-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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5131    316.   4.88   18.3   7:20   9:50  4175   624 2254   337
5131  1   37.0-999.0 128.0   6.0  41.0  46.0  39.0  48.0-888.0
5131  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5131  2    9.2  11.9   9.2   9.2   9.6   9.5   6.9   8.4-888.0
5131  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5131  3    2.8   2.7   2.7   2.6   2.5   2.7   2.0   2.3-888.0
5131  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5131  4    -.5   -.5   -.5   3.0    .9   1.7   -.5   1.4-888.0
5131  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5131  5     .5    .5    .5    .6    .5    .6    .4    .5-888.0
5131  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5131  6 -999.0    .8    .3    .5    .2    .3-999.0    .3-888.0
5131  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


5161    268.   1.26   19.2   8:20  10:50  3299   493 2057   307
5161  1   35.0  57.0  55.0  46.0  32.0  41.0  41.0-999.0-888.0
5161  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5161  2    3.7   4.3   3.8-999.0   2.4   2.8-999.0   4.4-888.0
5161  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5161  3    1.1   1.2   1.3   1.2   1.0   1.2    .9   1.2-888.0
5161  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5161  4    2.2   3.4   5.6   3.6   2.6   2.1   1.1   1.7-888.0
5161  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5161  5     .6    .9    .7-999.0    .9    .9    .7    .7-888.0
5161  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5161  6     .4    .6    .2-999.0    .5    .5    .6    .5-888.0
5161  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


5162    302.   2.09   22.0  11: 0  13:30  2148   321 2006   300
5162  1   45.0  48.0  57.0  64.0  46.0  52.0  46.0  57.0-888.0
5162  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5162  2    5.0   5.0   4.9   5.8   5.6   5.0   8.3   7.4-888.0
5162  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5162  3    1.7   1.7   1.7   1.7   1.5   1.6   1.5   1.8-888.0
5162  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5162  4     .9   1.9   2.2   4.1   2.3   2.8   1.4   2.3-888.0
5162  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5162  5     .7    .8    .9   1.0    .7    .8   1.0   1.1-888.0
5162  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5162  6     .7   1.3    .8   1.0    .7   1.0    .7   1.1-888.0
5162  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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5171   248.   1.47   19.2   7:10   8:20  4928   736 2372   354
5171 1   75.0  95.0  90.0 186.0  58.0  64.0  54.0-999.0-888.0
5171 1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5171 2   11.1  12.1  14.5-999.0  10.3-999.0   8.0  24.7-888.0
5171 2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5171 3    3.2   3.4   3.5   3.4   3.2   3.5   2.4   3.1-888.0
5171 3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5171 4    3.7   4.4   6.2   2.0   2.0   1.5   1.3   2.7-888.0
5171 4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5171 5    1.3   1.2   1.4    .9   1.0   1.0   1.0   1.1-888.0
5171 5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5171 6     .8   1.4    .7    .8    .7    .7    .9   1.4-888.0
5171 6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


5172   299.   1.78   24.5   8:50  11:10  2987   446 1941   290
5172 1   67.0  63.0  60.0  61.0  56.0  81.0  72.0  79.0-888.0
5172 1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5172 2   11.8  12.4  11.4  14.3  11.2  13.1   8.0  13.9-888.0
5172 2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5172 3    3.5   3.3   3.6   3.7   3.5   3.4   2.9   3.6-888.0
5172 3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5172 4    1.6   2.4   4.2   5.8   3.8   3.4   2.7   2.7-888.0
5172 4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5172 5     .8    .8    .7    .8    .7    .8    .6    .7-888.0
5172 5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5172 6     .5    .9    .3    .5    .3    .4    .6    .5-888.0
5172 6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


5181   306.   2.04   24.9   7:10   9:40  4304   643 2271   339
5181 1   73.0  90.0  77.0 103.0  79.0 106.0  97.0 115.0-888.0
5181 1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5181 2   40.3  39.5  37.5  18.3  40.8  34.9  32.7  38.2-888.0
5181 2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5181 3    9.1   9.4   9.4   9.3   7.8   8.9   7.8   9.6-888.0
5181 3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5181 4     .7   1.0   2.3   5.1   2.0   2.9   3.0   2.8-888.0
5181 4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5181 5     .7    .7    .4    .7    .9    .7    .7    .6-888.0
5181 5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5181 6     .2    .4-999.0-999.0    .2    .3    .4    .6-888.0
5181 6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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5191      56.   1.91   14.1   7:20   9:50   4175   624 2254   337
5191  1   51.0   50.0   56.0-888.0   56.0   52.0   91.0   49.0-888.0
5191  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5191  2   14.0   12.3   12.1-888.0   12.5   13.0    9.7    7.8-888.0
5191  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5191  3    3.3    3.2    3.3-888.0    3.4    3.3    2.9    2.2-888.0
5191  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5191  4    1.1    1.8    1.8-888.0    3.3    3.4    2.1    1.9-888.0
5191  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5191  5     .7     .7     .8-888.0     .4     .6     .7     .6-888.0
5191  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5191  6 -999.0     .4     .8-888.0     .3     .3     .7     .6-888.0
5191  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


5192      46.   3.74   15.0  10:30  13:10   2208   330 1949   291
5192  1   48.0   46.0   33.0   51.0   38.0   40.0-888.0   53.0-888.0
5192  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5192  2    8.5    8.6     .6-999.0    8.4    8.9-888.0   10.8-888.0
5192  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5192  3    1.0    2.7     .3    2.5    2.4    2.5-888.0    2.6-888.0
5192  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5192  4    -.6    -.6    -.6    4.9    2.0    1.6-888.0    1.4-888.0
5192  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5192  5     .8     .4     .8    1.0     .5     .5-888.0     .8-888.0
5192  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5192  6 -999.0-999.0-999.0-999.0-999.0     .2-888.0     .3-888.0
5192  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


5201     238.   1.11   13.2   5:50   8:20   4751   710 1824   273
5201  1   58.0   86.0-888.0   73.0   69.0   58.0   52.0   62.0-888.0
5201  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5201  2   10.7   10.8-888.0    9.4    8.9    8.9-999.0    8.9-888.0
5201  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5201  3    2.7    2.8-888.0    2.6    2.5    2.8    2.9    2.7-888.0
5201  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5201  4    4.4    6.4-888.0    3.4    2.1    1.1    1.2    1.7-888.0
5201  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5201  5    3.1    3.2-888.0    2.7    2.6    2.0    1.9    1.6-888.0
5201  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5201  6    1.9    2.5-888.0    1.8    1.6    1.6-999.0    1.6-888.0
5201  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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5202   207.   1.96   20.0   9:50  12:20   2411   360 1901   234
5202  1 -999.0  75.0-888.0  62.0  94.0  57.0  53.0  66.0-888.0
5202  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5202  2   10.9  10.8-888.0  13.3  10.9-999.0-999.0  11.7-888.0
5202  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5202  3    3.0   3.0-888.0   3.3   3.2   3.0   2.2   3.1-888.0
5202  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5202  4    3.7   5.1-888.0   3.0   2.4   1.9   1.5   1.7-888.0
5202  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5202  5    1.4   1.2-888.0   1.0   1.3-999.0-999.0    .9-888.0
5202  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5202  6    1.1   1.1-888.0   1.1    .7-999.0-999.0   1.1-888.0
5202  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


5232   212.   3.47   23.0  10:50  13:10   2163   323 1962   293
5232  1 -999.0  46.0-888.0  37.0  31.0  47.0  47.0-999.0-888.0
5232  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5232  2    4.6   4.2-888.0-999.0   4.5   5.0   3.8-999.0-888.0
5232  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5232  3    1.3   1.4-888.0   1.3   1.2   1.4   1.1    .1-888.0
5232  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5232  4    2.5   4.9-888.0   -.6    .9   -.6   -.6   -.6-888.0
5232  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5232  5    1.3   1.1-888.0-999.0   1.3   1.2   1.8   1.4-888.0
5232  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5232  6    1.1   1.0-888.0-999.0    .9   1.1   1.1    .9-888.0
5232  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0


5242   222.   3.62   23.9  10:20  12:50   2269   339 1928   288
5242  1   61.0  69.0-888.0  81.0  45.0  57.0 106.0  81.0-888.0
5242  1 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5242  2   12.0  13.0-888.0  12.3  11.6  12.2   9.3  11.4-888.0
5242  2 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5242  3    3.5   4.0-888.0   3.7   3.4   3.7   2.9   3.4-888.0
5242  3 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5242  4    2.3   5.2-888.0   -.6   -.6   -.6   -.6   -.6-888.0
5242  4 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5242  5     .5    .5-888.0    .5    .4    .5    .4    .5-888.0
5242  5 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
5242  6    1.3   1.3-888.0   1.5   1.1   1.3   1.6   1.7-888.0
5242  6 -888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0-888.0
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10051      63.   3.59   13.0  11: 0  13:30  2148   321 2006   300
10051  1  -888.0-888.0  22.0  36.0  26.0  33.0  25.0  20.0  33.0
10051  1  -888.0-888.0   4.0-999.0  19.0-999.0  16.0  11.0  24.0
10051  2  -888.0-888.0   4.4   4.5   4.4   4.1   4.9   4.3   5.4
10051  2  -888.0-888.0    .7    .4    .6    .8    .7    .0    .6
10051  3  -888.0-888.0   1.6    .8   1.4   1.4   1.8   1.6   1.8
10051  3  -888.0-888.0    .1   -.1   -.1    .1    .2    .1    .1
10051  4  -888.0-888.0   1.6   6.4   2.7   3.6   3.6   2.9   1.5
10051  4  -888.0-888.0    .8   1.0   -.5   -.5    .8   1.4    .7
10051  5  -888.0-888.0    .5   1.0    .5    .6    .9    .6    .9
10051  5  -888.0-888.0   1.2    .5   1.3   1.2   1.5   1.6   1.4
10051  6  -888.0-888.0    .5    .4-999.0    .4    .4    .5    .5
10051  6  -888.0-888.0    .4    .2    .4    .5    .6    .4    .4


10052      58.   2.97   14.2  14:20  16:30  2736   409 3820   571
10052  1  -888.0-888.0  29.0  40.0  48.0  39.0  31.0  26.0  40.0
10052  1  -888.0-888.0  14.0   8.0  18.0  18.0-999.0  11.0  24.0
10052  2  -888.0-888.0   4.7   4.8   4.7   4.5   5.3   4.9   5.6
10052  2  -888.0-888.0-999.0    .4-999.0    .8-999.0-999.0    .8
10052  3  -888.0-888.0   1.5   1.5   1.4   1.3   1.8   1.6   1.5
10052  3  -888.0-888.0   -.1   -.1   -.1   -.1    .1   -.1   -.1
10052  4  -888.0-888.0   1.2   8.0   4.1   4.7   3.7   3.7   3.1
10052  4  -888.0-888.0   -.9   1.6   1.6   -.8   -.8    .9   1.2
10052  5  -888.0-888.0    .3    .9    .5    .6   1.2    .8    .6
10052  5  -888.0-888.0   1.1    .4   1.0   1.0-999.0    .6   1.1
10052  6  -888.0-888.0-999.0    .5    .4    .5    .4    .8    .7
10052  6  -888.0-888.0    .8-999.0    .9    .9-999.0    .6   1.5


10072     231.   2.21   19.6  14: 0  16:20  2690   402 3592   537
10072  1  -888.0-888.0  81.0  71.0  50.0  59.0  51.0  41.0  56.0
10072  1  -888.0-888.0  37.0  15.0  22.0  32.0-999.0  39.0  35.0
10072  2  -888.0-888.0  20.9  25.0  22.6  24.0  22.8  23.0  18.9
10072  2  -888.0-888.0   1.8   1.1   2.4-999.0   1.4    .2   1.6
10072  3  -888.0-888.0   6.6   7.9   6.8   8.0   7.0   8.2   6.6
10072  3  -888.0-888.0    .5    .2    .3    .5    .3    .5    .3
10072  4  -888.0-888.0   7.7   2.0   1.0   1.3   -.7   1.1   1.4
10072  4  -888.0-888.0   1.9   -.7   -.7   -.7   -.7   -.7   -.7
10072  5  -888.0-888.0-999.0   1.5    .9   1.4    .9   1.0-999.0
10072  5  -888.0-888.0    .9   1.1    .9   1.1   1.0   1.0   1.0
10072  6  -888.0-888.0-999.0    .8    .3    .4-999.0    .1-999.0
10072  6  -888.0-888.0    .7    .4    .7    .7    .7-999.0    .6
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